ENGINEERING
TOMORROW

Application Guide

iC7 Series Grid Converter

iC7-Hybrid

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Contents

1 Introduction to the Application Guide

1.1 Version History

This guide is regularly reviewed and updated. All suggestions for improvement are welcome.

The original language of this guide is in English.

Version	Remarks	Software Version
AB426216113631en-000201	General Release 2	5.17.0
AB426216113631en-000101	General Release 1	5.6.5

1.2 Purpose of this Application Guide

This application guide provides information on operating the Grid Converter application of the iC7 series. The application guide provides an overview of parameters and value ranges for operating the drive.

In addition to drive parameters, information on the various user interfaces to configure drive parameters, configuration examples with recommended parameter settings and troubleshooting steps are included in the application guide.

1.3 Intended Audience

The intended audience of the application guide is trained personnel, automation engineers, and configurators with experience in operating with parameters and with basic knowledge of AC drives.

1.4 Additional Resources

Additional resources are available with related information.

The iC7-Hybrid PROFINET guide and iC7 Modbus guide include information on how to configure the fieldbus.

The Design Guide provides information about the capability and functionality to design power conversion systems with Danfoss iC7 series.

The Safety Guide provides important safety information related to iC7 series.

The Installation Guide covers the mechanical and electrical installation of power converters.

1.5 Safety Symbols

The following symbols are used in Danfoss documentation.

⚠ DANGER

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

Indicates information considered important, but not hazard-related (for example, messages relating to property damage).

The guide also includes ISO warning symbols related to hot surfaces and burn hazard, high voltage and electrical shock, and referring to the instructions.

	ISO warning symbol for hot surfaces and burn hazard
	ISO warning symbol for high voltage and electrical shock
	ISO action symbol for referring to the instructions

2 Introduction to iC7-Hybrid

2.1 Overview

iC7-Hybrid is an enabler in electrification and hybridization applications. iC7-Hybrid covers all power conversion needs in low voltage AC and DC systems. iC7-Hybrid can be used to integrate diverse energy sources and energy storage to a utility grid, microgrid, or DC distribution. Some of the typical applications include:

- peak shaving
- time shifting
- backup power
- grid forming
- power quality
- marine shore supply

The following application software is available in iC7-Hybrid:

- **Grid Converter:** Grid Converter is a dedicated power converter for grid forming, advanced grid control, and bi-directional AC/DC power conversion. Grid Converter is an ideal inverter solution for smart grid applications such as micro grid forming, AC coupled energy storage, shaft generator grid interface, and other flexible AC/DC or AC/AC power conversion applications.
- **DC/DC Converter:** The DC/DC Converter is a bi-directional power converter, enabling interconnection of two direct current (DC) systems having different voltage levels. Some of the benefits of the DC/DC converter are a wide source voltage range and the possibility for accurate current, voltage, or power control. The DC/DC converter overcomes the mismatches between the operating voltage ranges of the energy source and the system DC voltage and enables the flexible combining of different power source technologies in one system.
- **Generator:** Generator is a multipurpose inverter targeted for the power generation and advanced multi-purposes use cases in marine vessels. It can be used to control shaft generators, auxiliary generators and motors in vessels as well as shore connection to the electric grid at harbor. The Generator application provides the interface between variable speed AC power generation or motor and the DC bus of the system. The same physical hardware can be used for motor/generator control as well as the on-board shore connection.

Table 1: iC7-Hybrid Application Software Compatibility

Product	Application Software	Hardware Compatibility
iC7-Hybrid	Grid Converter	Liquid-cooled System Modules
	DC/DC Converter	Liquid-cooled System Modules
	Generator	Liquid-cooled System Modules

Danfoss offers a power converter FMU model for system simulation, which includes full functionality of the power conversion control and application layer. A hardware in the loop (HIL) simulation setup of the iC7 Series controller is also available for real time simulation purposes, such as PLC integration testing.

3 Grid Converter Application Software Overview

3.1 Introduction to Grid Converter Application Software

Grid Converter is used for grid forming, advanced grid control, and bi-directional AC/DC power conversion. Grid Converter can create an AC grid on its own (Island mode) or operate in parallel with other generating units (droop control/microgrid mode). Active and reactive power control mode (PQ-control) is provided for fast power control. It is also possible to control AC power by offsetting the droop curve in droop control with base load control mode. Grid forming power control modes have the advantage that the power flow can be controlled, and black-outs prevented, in case other generation is lost in the microgrid. Advanced DC-link voltage control, DC-link power control, and DC-link current control modes are also available for DC load applications, such as electrolyzers or motor drives.

Grid Converter can change smoothly from one operating mode to another, which provides flexibility and stability to the power system. The short circuit current injection feature can be used to activate protective devices when a fault occurs in a microgrid. When a fault is detected, Grid Converter feeds high short-circuit current to the grid, and normal operation continues after the fault is cleared.

The electrical schematic of the Grid Converter is presented in Figure 1 and Figure 2. The schematic is based on the 3-phase inverter topology with a capacitor bank in the DC link. There is also an AC line filter that is filtering the high frequency current produced by the pulse width modulation from the grid current waveforms. The line filter is either an LCL or LC circuit, with a dedicated transformer. The electrical topology enables bi-directional power flow control. Alternating voltage and current are rectified into direct current when power is transferred from the AC system to the DC system. The direct current and voltage are inverted to alternating current when power is transferred from the DC system to the AC system.

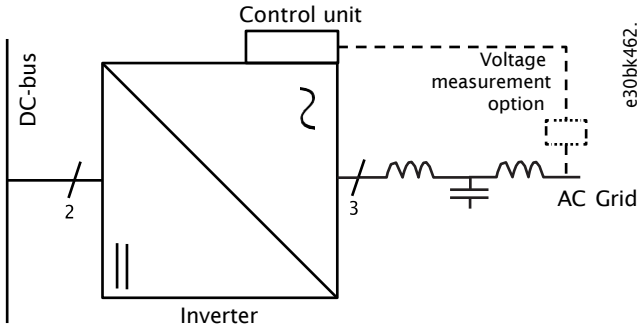


Figure 1: The Grid Converter consists of a 3-phase inverter, a control unit, and an LCL filter. AC voltage measurement is optional.

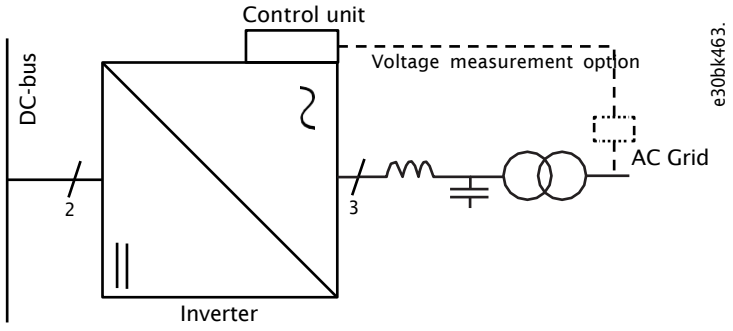


Figure 2: The LCL filter can be replaced with an LC filter and a dedicated transformer. The LC filter and transformer are equivalent to the LCL filter from the point of view of the circuit.

Grid Converter supports both open loop (without auxiliary mains voltage measurement) and closed loop AC voltage and frequency control schemes. The frequency and voltage droop controls handle load sharing between other generating units, and reactive power management (droop control mode). The droop curves can be offset with references to adjust power when operating in base load mode. The references are given either as active and reactive current or power. DC-link undervoltage and overvoltage controllers can be used to manage the DC-link voltage level in the grid-forming control modes (microgrid). Alternatively, Grid Converter can be operated in the DC

voltage control mode (AFE), providing closed loop DC-link voltage regulation. A wide range of limiting and protection functions enable easy and safe power management system design. On-the-fly transitioning between the control modes is possible, to increase system design possibilities and redundancy. Grid Converters can be paralleled with or without communication between converters according to system needs. Paralleling provides flexible scalability of the system into high powers.

The following illustrations depict typical Grid Converter system solutions:

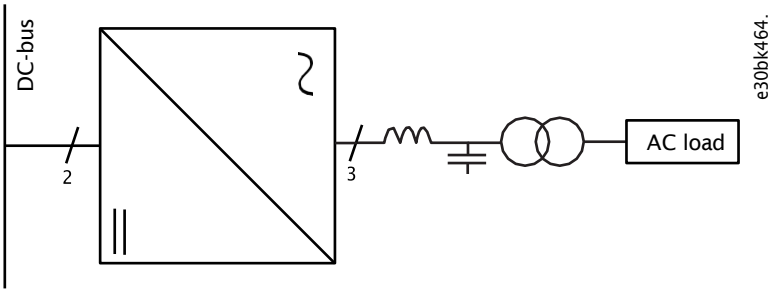


Figure 3: Grid converter for creating and supplying a microgrid system.

Typical use cases include an onboard microgrid for marine vessel hotel loads, a local microgrid in rural areas, or a shore supply system.

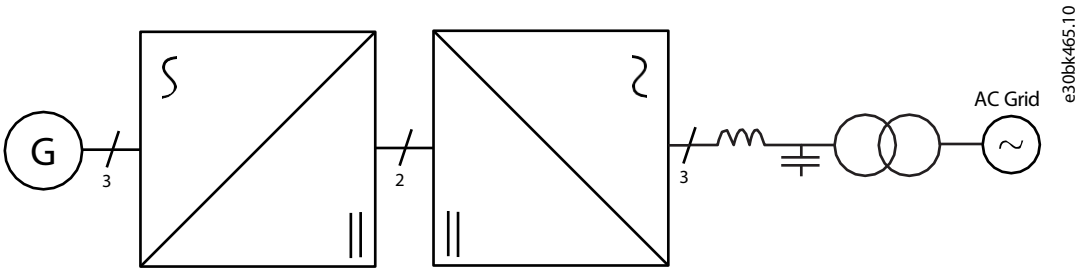


Figure 4: Distributed power generation with Grid Converter as the grid interface.

A system application example is a marine shaft generator system with Grid Converter as an interface to the onboard AC distribution system.

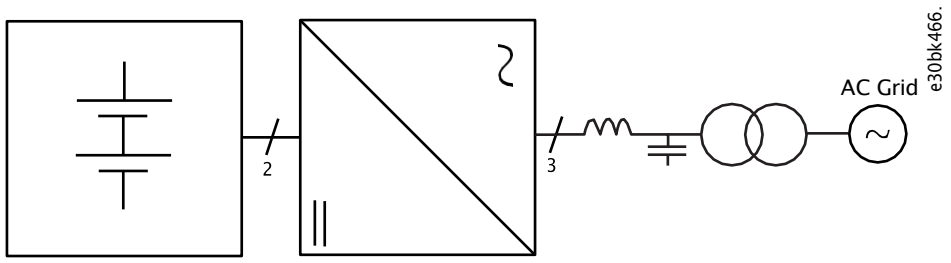


Figure 5: An AC coupled energy storage system

Energy storage is directly connected to the DC link of the grid converter to realize an AC coupled energy storage system.

The Grid Converter software includes the primary controls for voltage, frequency, and power, and the converter-level controls for DC-link voltage, power, and current. These features are implemented using converter-level measurements and available option board extensions including the external AC voltage measurement. Grid Converter can synchronize the local microgrid to an external grid with the help of the voltage measurement option.

The flexible communication interface and wide range of adjustable features support the end users to complete the system with hierarchical or decentralized controls. Power and energy management systems (PMS, EMS) are needed on the system level since the Grid Converter application software only provides the functions to implement the power conversion control and limitations. If batteries are used with the Grid Converter, a battery management system (BMS) is mandatory for safety. The items supplied by Danfoss are a component in the system and the system integrator is responsible for the system level implementation of the installation.

Overview of the Grid Converter application software functionality is illustrated in Figure 6. The Grid Converter application software provides functions to handle the start and stop sequences from different control places and includes the control of the interfacing circuit breaker and pre-charging circuit. Auxiliary protection features such as filter temperature monitoring and cooling unit supervision are also available. Flexible interfaces are provided towards the upper system, including a configurable fieldbus interface and customizable I/O interfaces. Flexible PC tools and a local control panel are available for the user interface. With the help of these features, the Grid Converter can be smoothly interfaced with external power and energy management systems (PMS, EMS) or with a battery management system (BMS). The Danfoss iC7 control platform offers an application PLC programming feature that makes it possible to incorporate additional functionality in the application software that is run on the control unit.

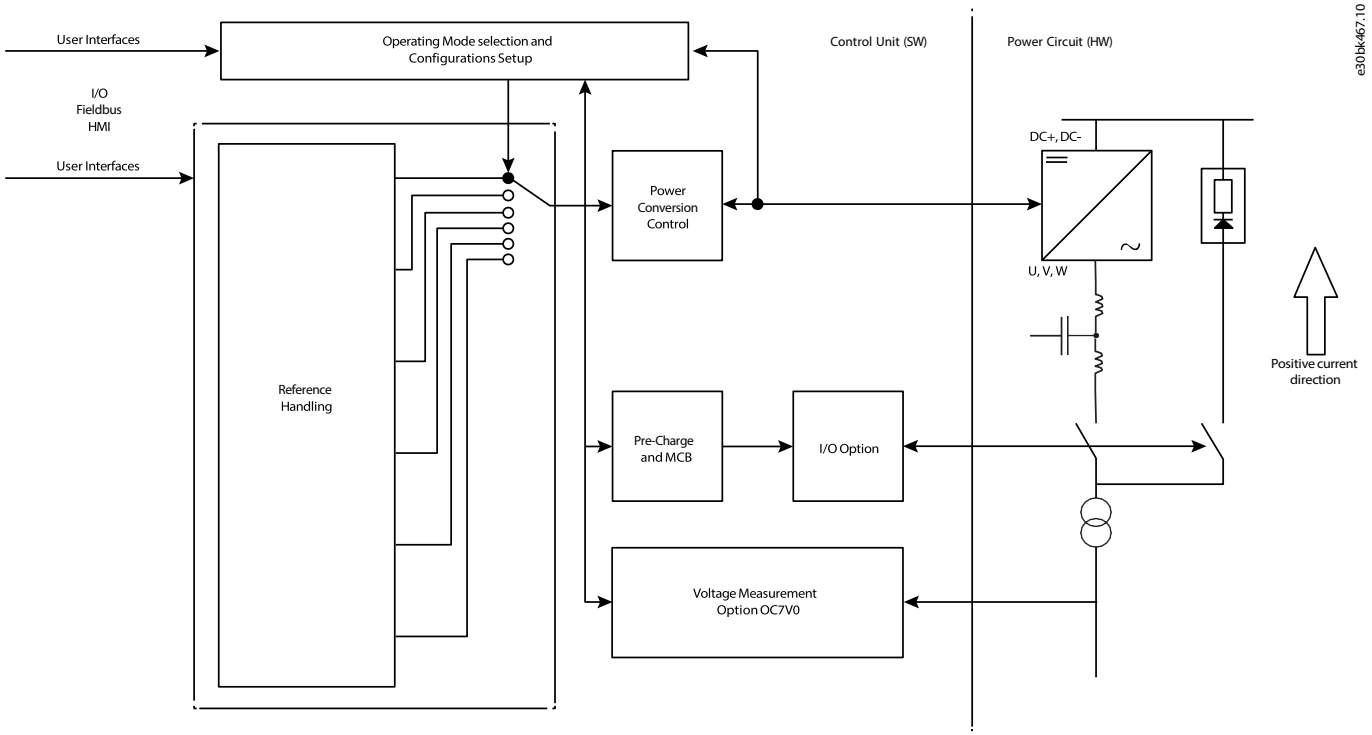


Figure 6: Grid Converter application software overview

3.2 Supported Fieldbus Communication Protocols

Supported fieldbus protocols based on product configuration:

Table 2: Fieldbus Protocols

Fieldbus Protocol	Availability
MODBUS TCP	Embedded protocol For configuration, refer to the iC7 Series Modbus Operating Guide.
PROFINET	Embedded protocol, but requires a license to activate For configuration, refer to the iC7-Hybrid PROFINET Operating Guide.

3.3 Grid Converter Operation Modes

Grid Converter has five operation modes, and the available references and limit controllers with priority order are summarized in the table.

Transitions between the operation modes can be done instantly, for example through the fieldbus control word. As an example, the transition from DC-link voltage control to droop control when the operating mode of a shaft generator system is changed from Power Take In (PTI) to Power Take Out (PTO). Supplementary voltage-limiting controllers and current limits can be enabled or disabled when required. By default, all limit controllers are active for all operation modes. The following table provides an overview of how different modes can be used together with different limit controllers.

Table 3: Grid Converter Operating Modes

Type	Mode	References	Description
Grid forming	Island	Grid frequency Grid voltage	Normal operation • The primary control objective is to regulate source frequency and voltage to a fixed value, such as when the converter operates in isochronous (fixed voltage and frequency) mode. • Active and reactive power is determined by load. • Only one isochronous converter can be connected to the same grid.
		Grid current limit DC-link undervoltage limit DC-link overvoltage limit	Operation in limit control • The primary control objective is to limit current. • The secondary limit control objective is to limit DC-link voltage.
	Droop Control (Microgrid mode)	Grid frequency Grid voltage	Normal operation • Voltage and frequency regulated based on drooping curves. • Active and reactive power is determined by load. • Parallel converters connected to the same grid share load by drooping.
		Current limit DC-link overvoltage limit DC-link undervoltage limit	Operation in limit control • Primary control objective is to limit the current • Secondary control objective is to limit the DC-link voltage
	Droop control with base load	Grid frequency Grid voltage Active current or power Reactive current or power	Normal operation • Voltage and frequency regulated based on drooping curves • Active and reactive power is determined by load • Drooping curves are offset based on current/power references • Parallel converters connected to the same grid share load by drooping
		Current limit DC-link overvoltage limit DC-link undervoltage limit	Operation in limit control • The primary control objective is to limit current. • The secondary limit control objective is to limit DC-link voltage.
	PQ control	Active current or power Reactive current or power	Normal operation • Power determined based on upper control system • Parallel converters connected to the same AC bus share the load based on the given references
		DC-link overvoltage limit DC-link undervoltage limit	Operation in limit control • DC-link limit control

Table 3: Grid Converter Operating Modes *(continued)*

Type	Mode	References	Description
Grid following	DC voltage control (AFE control)	DC-link voltage Reactive current	Normal operation • Active power based on DC-link load • Reactive power controllable
		Grid current limit	Operation in limit control • Primary control objective is to limit grid current
	AC current or power control	Active current or power Reactive current or power	
		Current limit DC-link overvoltage limit DC-link undervoltage limit	Operation in limit control • Primary control objective is to limit grid current • Primary control objective is to limit DC-link voltage
	DC current or power control	DC current or power Reactive current or power	Normal operation • Control DC-link current or power
		Current limit DC-link overvoltage limit DC-link undervoltage limit	Operation in limit control • Primary control objective is to limit grid current • Primary control objective is to limit DC-link voltage

3.4 Operating Principles

3.4.1 Island Mode

In Island mode, the grid converter forms and powers the AC grid. Drooping is disabled and thus the unit operates with fixed voltage and frequency as per the references. The unit cannot operate in parallel with other island mode units without converter-to-converter communication. The other power-generating units in the system operate in the grid-following mode or use some other method for PQ control. In island mode, the converter always starts with voltage ramp, meaning that the voltage is ramped from zero to the reference to energize the AC system.

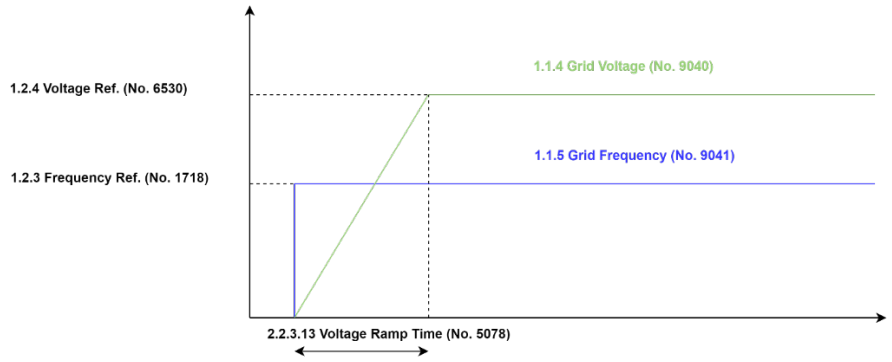


Figure 7: Island Mode Start

Voltage and frequency reference source can be configured as nominal grid values or references can be set through the fieldbus interface. The digital potentiometer makes it possible to adjust references, for example using the fieldbus control word. The U/f curve and voltage and frequency ramps define the internal grid voltage and frequency reference, which are then fed to voltage and current controllers. DC-link overvoltage and undervoltage controllers and current limit controllers are available in island mode.

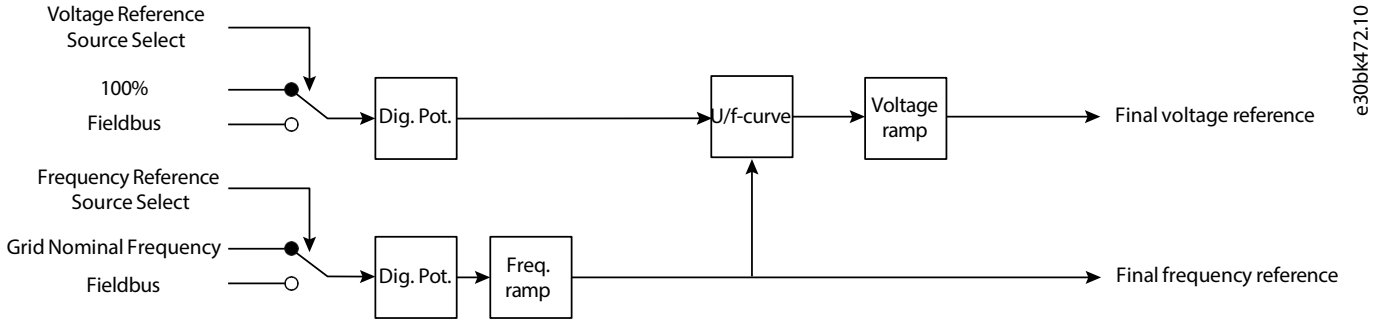


Figure 8: Voltage and frequency reference chain

3.4.2 Droop Control (Microgrid Control)

In droop control, also called microgrid control, Grid Converter operates using AC grid frequency and voltage drooping which guarantees active and reactive power sharing between other generating units.

The voltage and frequency reference source can be programmed to be nominal grid values, or the reference can be given through the fieldbus interface. The digital potentiometer makes it possible to adjust references, for example using the fieldbus control word. The U/f curve and voltage and frequency ramps, as well as the droops, define the internal grid voltage and frequency reference, which are then fed to voltage and current controllers.

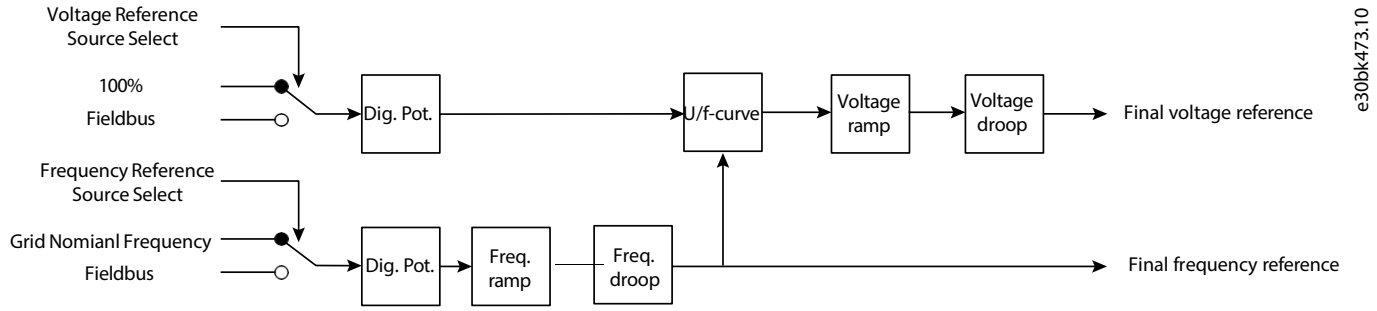


Figure 9: Reference chain in droop control

In droop control mode, the converter starts with the detected grid voltage and frequency before ramping them to given references. When grid voltage is not detected, the voltage ramp is applied similarly as in Island mode. The digital potentiometer function provides high or low frequency (power) up and down and voltage up and down interfaces, and resets the reference to measured values before start. Then it is possible to start with zero active and reactive power. DC-link overvoltage controllers, undervoltage controllers, and current limit controllers are available in droop control mode.

Examples of frequency and voltage droop curves are shown in Figure . The figures are derived by defining the positive current direction as being from AC towards DC, which is the default configuration in the software. The positive current direction is selectable and can be configured in the application software with parameter ***Current/Power Positive Direction (2947)***. The curves show that the frequency droops as a function of active current and the voltage as a function of reactive current. Droop characteristics are defined by nominal values, droop gains, and the nominal grid current as follows:

$$f - f^* = -k_f I_{act}$$

$$U - U^* = -k_U I_{react}$$

where f and f* are actual and reference frequency, U and U* are actual and reference grid voltage, I_{act} and I_{react} are the active and the reactive currents in % of the nominal grid current. The frequency and voltage droop gains are:

$$k_f = \Delta f / \Delta I_{act}$$

$$k_U = \Delta U / \Delta I_{react}$$

where Δf and ΔU are the change in frequency and voltage and ΔI_{act} and ΔI_{react} are the change in active and reactive current. The droop gains define the frequency and voltage change when the active and reactive current is equal to nominal grid current, respectively.

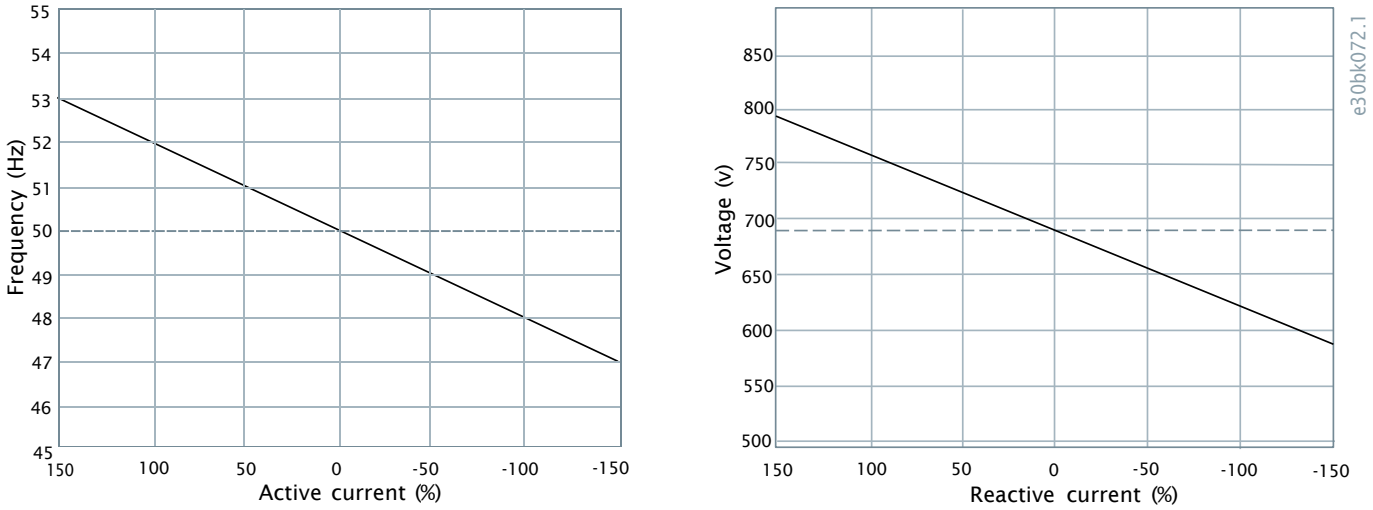


Figure 10: Frequency and voltage droop (Frequency droop 2 Hz and grid nominal frequency 50 Hz, voltage droop 10% and grid nominal voltage 690 V)

The droop gains can be set with parameters ***Freq. Droop Gain (No. 5063)*** and ***Voltage Droop Gain (No. 5085)***.

3.4.3 Droop Control with Base Load

Fundamentally, the droop with base load operating mode is similar to droop mode, with the exception that voltage and frequency references are offset based on specified current or power reference. The base load references can be specified as active and reactive current or active and reactive power. Active current reference affects the frequency reference, and reactive current reference affects the voltage reference. The following picture shows a block diagram explaining the basics of droop control with base load.

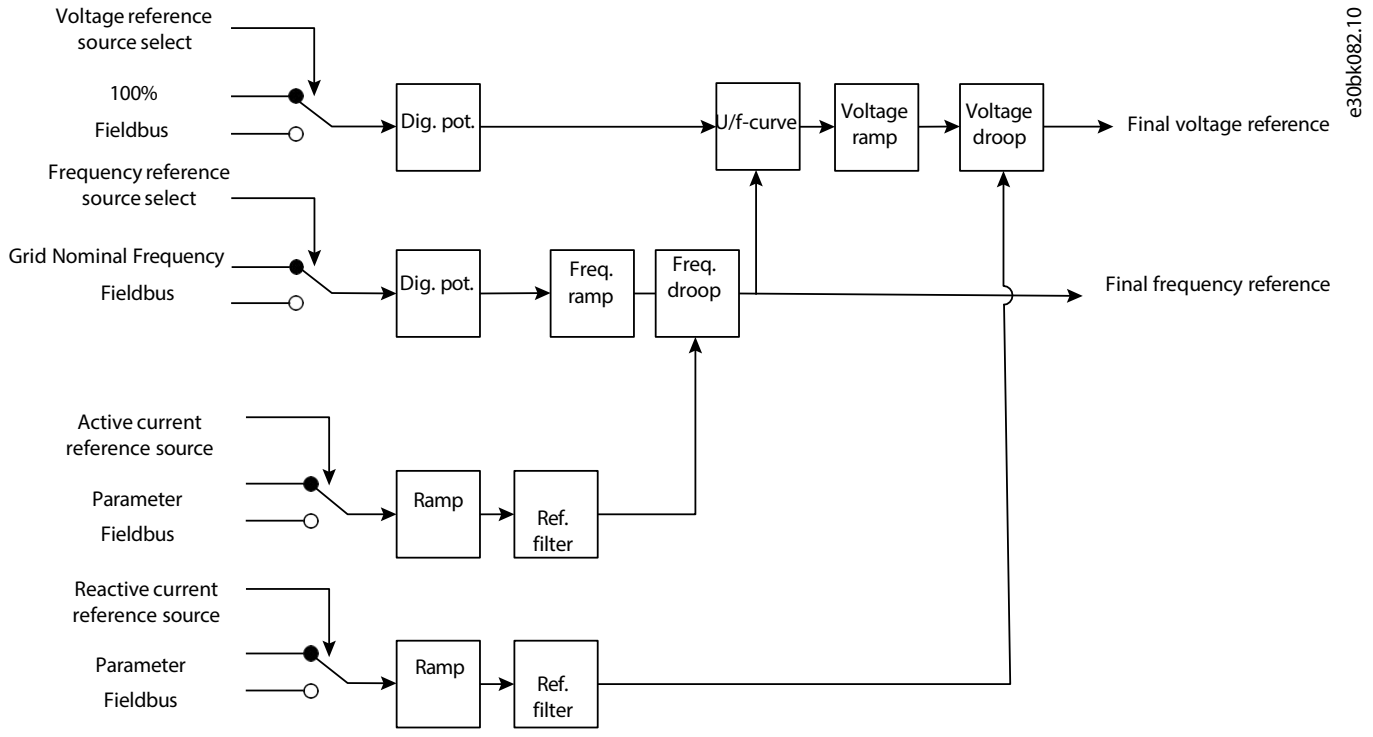


Figure 11: Droop control with base load

Droop curve offsetting based on active and reactive current reference is illustrated in Figure 12. Increasing the active current reference decreases the frequency reference and thus increases the power taken from the grid. Increasing the reactive current reference decreases the voltage, and Grid Converter draws more reactive power from the grid. Droop characteristics with base load are defined as:

$$f - f^* = -k_f\left(I_{act} - k_{df} I^*_{act}\right)$$

$$U - U^* = -k_U\left(I_{react} - k_{dU} I^*_{react}\right)$$

and

$$k_f = \Delta f / \Delta I_{act}$$

$$k_U = \Delta U / \Delta I_{react}$$

where Δf and ΔU are the change in frequency and voltage, and ΔI_{act} and ΔI_{react} are the change in active and reactive current. f and f* are actual and reference frequency, U and U* are actual and reference grid voltage, I_{act} and I_{react} are the active and the reactive currents in % of the nominal grid current. I^*_{act} and I^*_{react} are the active and the reactive reference in % of the nominal grid current, and k_{df} and k_{dU} are the scaling factors for the reference offset. The droop gains can be set with parameters ***Freq. Droop Gain (No. 5063)*** and ***Voltage Droop Gain (No. 5085)***. The scaling factors for the reference offset are 100% by default, and can be set with parameters ***Freq. Droop Gain Base Load Scale (No. 5065)*** and ***Voltage Droop Gain Base Load Scale (No. 5087)***.

In the software, the droop gains define the frequency and voltage change when the active and reactive current is equal to the nominal grid current, respectively.

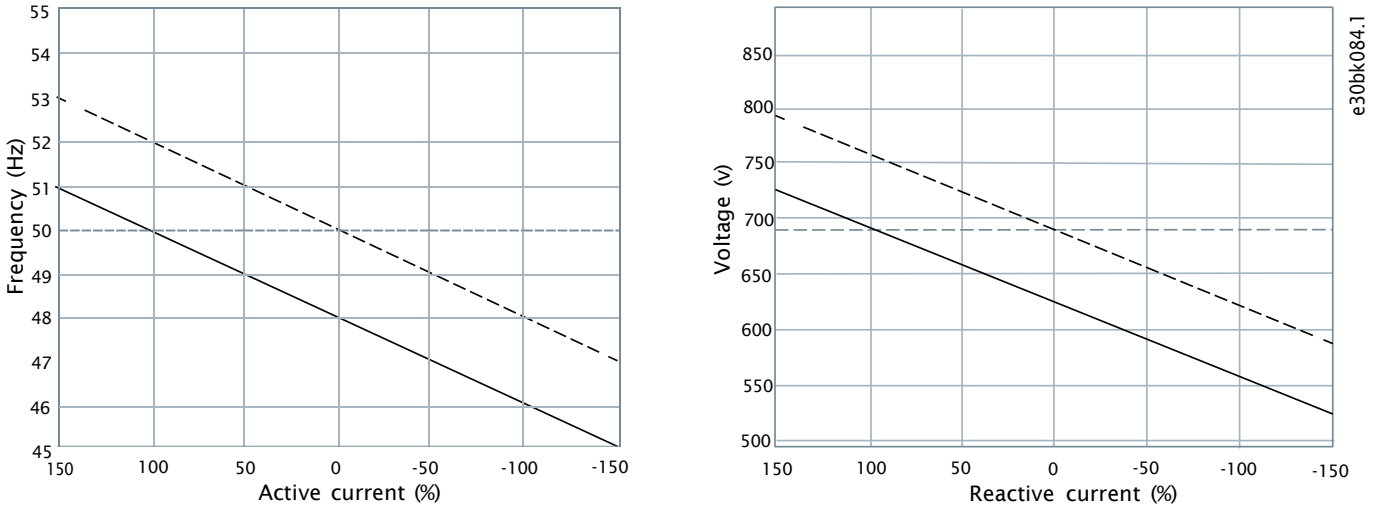


Figure 12: Solid curves show droop with base load (active reference 100% and reactive reference 100%). Dashed curves are the original droop curves.

Base load control can be characterized as an open loop power control mode. Actual power follows the reference if the grid can be regarded as isochronous (fixed frequency) and the frequency is unaffected by the changes in the output of the grid converter. Similarly, actual reactive power follows reactive reference only if the grid voltage magnitude is not affected by the Grid Converter reactive power output.

3.4.4 PQ Control

In PQ-control control mode, the frequency and voltage are actively controlled, so that grid converter follows the specified active and reactive current or power references. That means it is a closed loop power control mode. The references can be given for active and reactive current or active and reactive power. DC-link overvoltage and undervoltage controllers and current limit controllers are available.

PQ Control is based on the grid-forming control principle, so it can automatically support the grid if the grid frequency limit is reached. In this case Grid Converter stops following the power reference and prevents a blackout in the grid. Grid frequency is maintained at the limit.

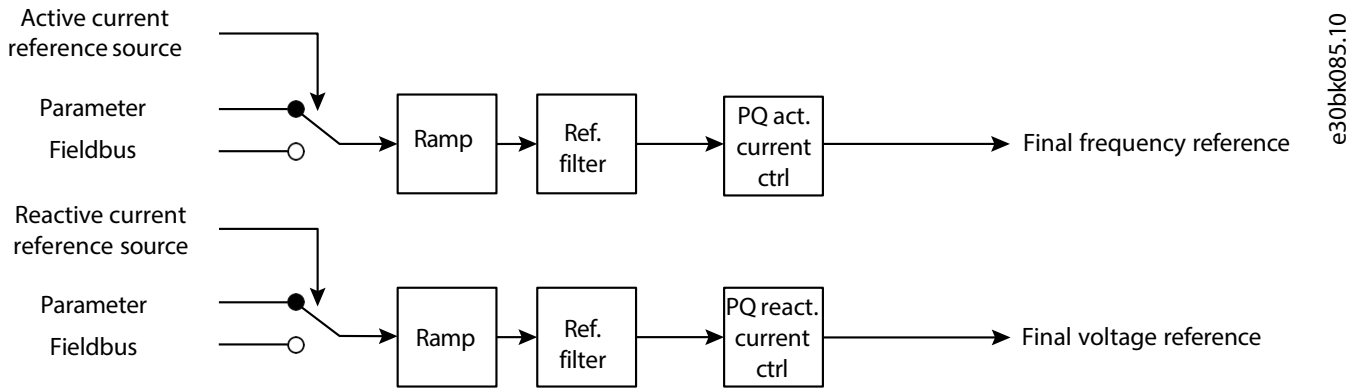


Figure 13: PQ control

3.4.5 DC-link Voltage Control (AFE Control Mode)

In DC-link voltage control mode (AFE control mode), Grid Converter synchronizes to the grid voltage and uses direct control of active and reactive currents. Grid Converter regulates the DC-link voltage at the reference value by controlling the active current of the grid. The DC-link voltage reference is specified as a percentage of system nominal DC-link voltage. DC-link voltage droop is used to ensure load sharing between parallel connected converters with individual control units. The reactive current controller follows the given reference.

The -defined current limits are applied on the final current references. The dynamic behavior of the DC-link voltage controller and current controllers can be modified with parameters specified in percentages of internal default values.

3.4.6 AC Current and Power Control

In AC current and power control mode, the power and current control can be used in a similar way as it has been used in PQ mode, and all the parameters for the dynamic behavior apply in the same way as in PQ mode. The grid-following AC power control mode offers a faster dynamic response than the grid-forming mode.

3.4.7 DC Current and Power Control

In DC-link current and power control mode, the grid converter synchronizes to the grid voltage and uses the DC current or power reference to control active current or power. The DC-link current or power reference is given as percentage of the system nominal DC-link current or power.

The -defined current limits are applied to the final current references. The dynamic behavior of the DC-link current and power control can be modified in percentages of internal default values, set with parameters.

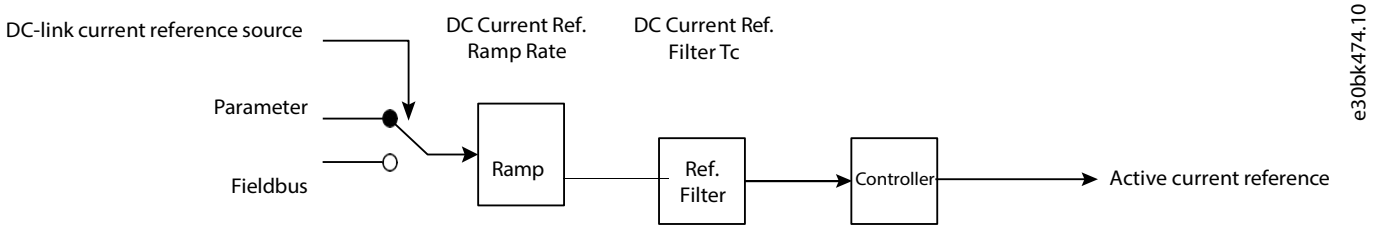


Figure 14: DC current control

3.4.8 DC-link Current Control with Customizable Droop Curve

In DC-link current control mode, the converter synchronizes to the grid voltage and uses the DC current reference to control active current or power. The DC-link current reference is given as a percentage of the nominal DC-link current.

The configurable current limits are applied to the final current references. DC-link current control mode also makes it possible to define a droop curve where the DC-link current droops based on the function of DC-link voltage. The droop curve is added to the DC-link current reference, which is set by using either parameter ***DC Current Reference %*** or Fieldbus process data.

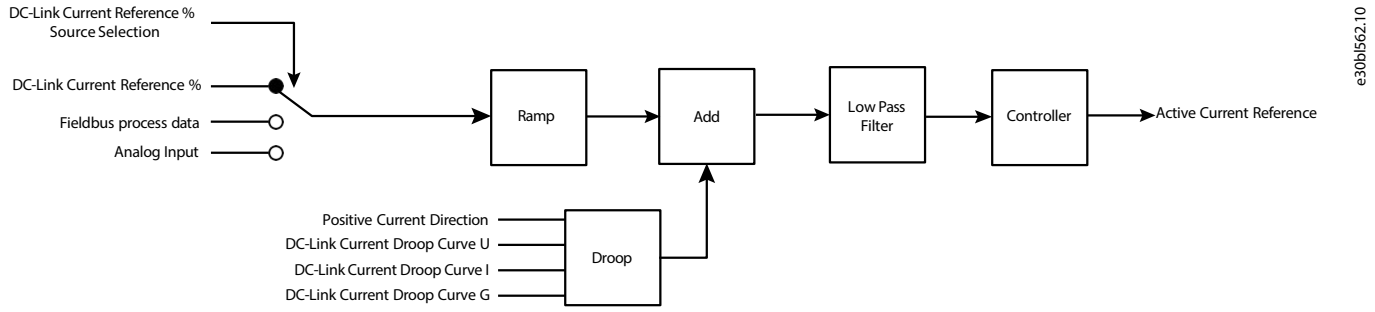


Figure 15: DC-link current control

DC-link Current droop curve can be configured using the following parameters:

- ***DC-link Current Droop Curve U***
- ***DC-link Current Droop Curve I***
- ***DC-link Current Droop Curve G***

All the previous parameters are arrays with 4 points each, that define the droop curve configuration. These 4 points have been defined as follows:

- U1, U2, U3, and U4 for DC-link Current Droop Curve U
- I1, I2, I3, and I4 for DC-link Current Droop Curve I
- G1, G2, G3, and G4 for DC-link Current Droop Curve G

The droop curve is bounded with parameters ***Overvoltage Ctrl. Level*** and ***Undervoltage Ctrl. Level***. The output of the droop curve block in the following image is forced to 0 when the DC-link voltage goes outside the overvoltage and undervoltage limits that are set with these parameters.

To make a linear droop curve, the control points must be parameterized in the following way:

- G1=G2=G3=G4=G*
- I1=I2=-100%
- I3=I4=100%

For the DC-link voltage range, use the following points: U1= Undervoltage Ctrl. Level, U2=U3=100%, and U4= Overvoltage Ctrl. Level.

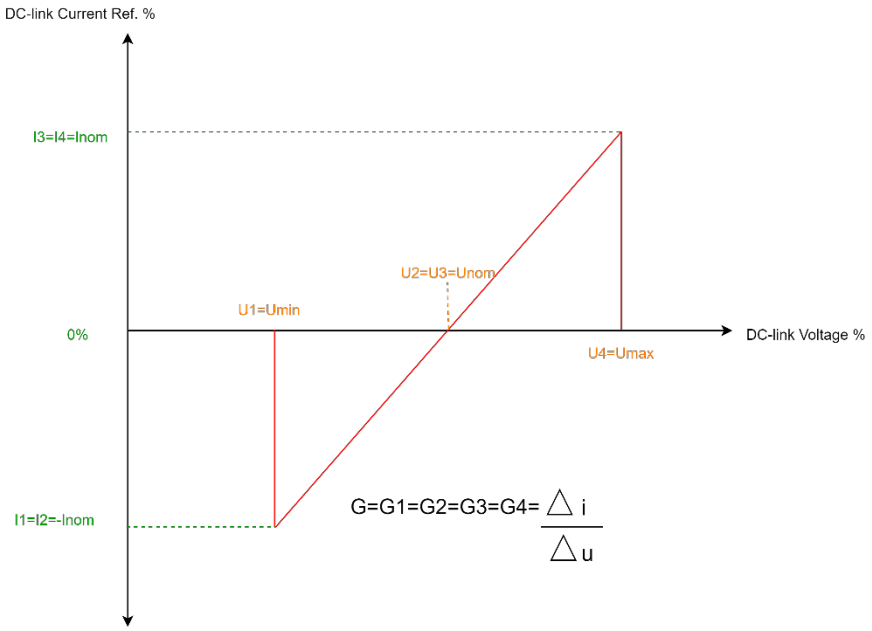


Figure 16: Current droop curve

For a more advanced droop curve, all the four array elements of the parameters correspond to the following table & figure:

Table 4: Droop curve configuration

Configuration point	Description	Unit	Range
I1	Maximum current in the negative direction	%	I1 ≤ I2
I2	Constant current in the negative direction after slope G1	%	I2 ≤ 0
I3	Constant current in the positive direction after slope G3	%	0 ≤ I3
I4	Maximum current in the positive direction	%	I3 ≤ I4
Umin	Minimum DC-link voltage	%	Umin ≤ U1
U1	Voltage corresponding to I2	%	U1 ≤ U2
U2	Minimum voltage for 0 current	%	U2 ≤ Unom
Unom	Nominal DC-link voltage	%	Unom ≤ U3
U3	Start voltage for slope G3	%	U3 ≤ U4
U4	Start voltage for slope G4	%	U4 ≤ Umax
Umax	Maximum DC-link voltage	%	Umax ≥ U1, U2, U3, U4, Unom, Umin

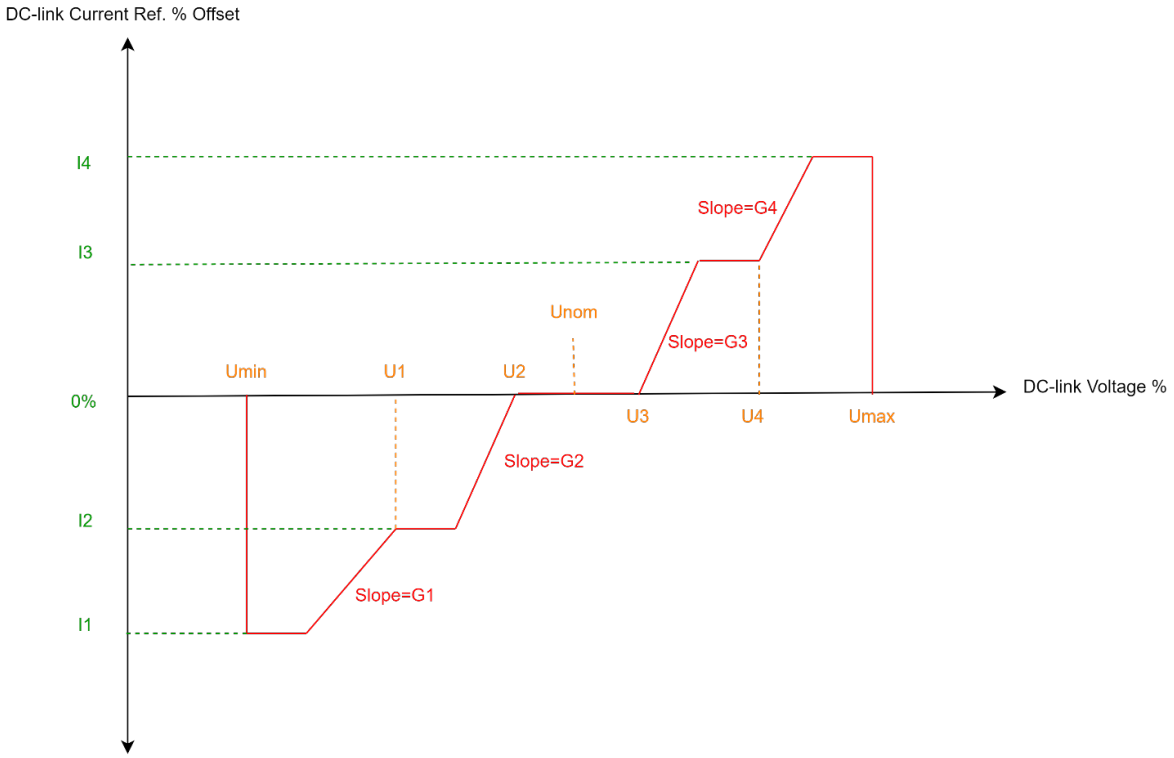
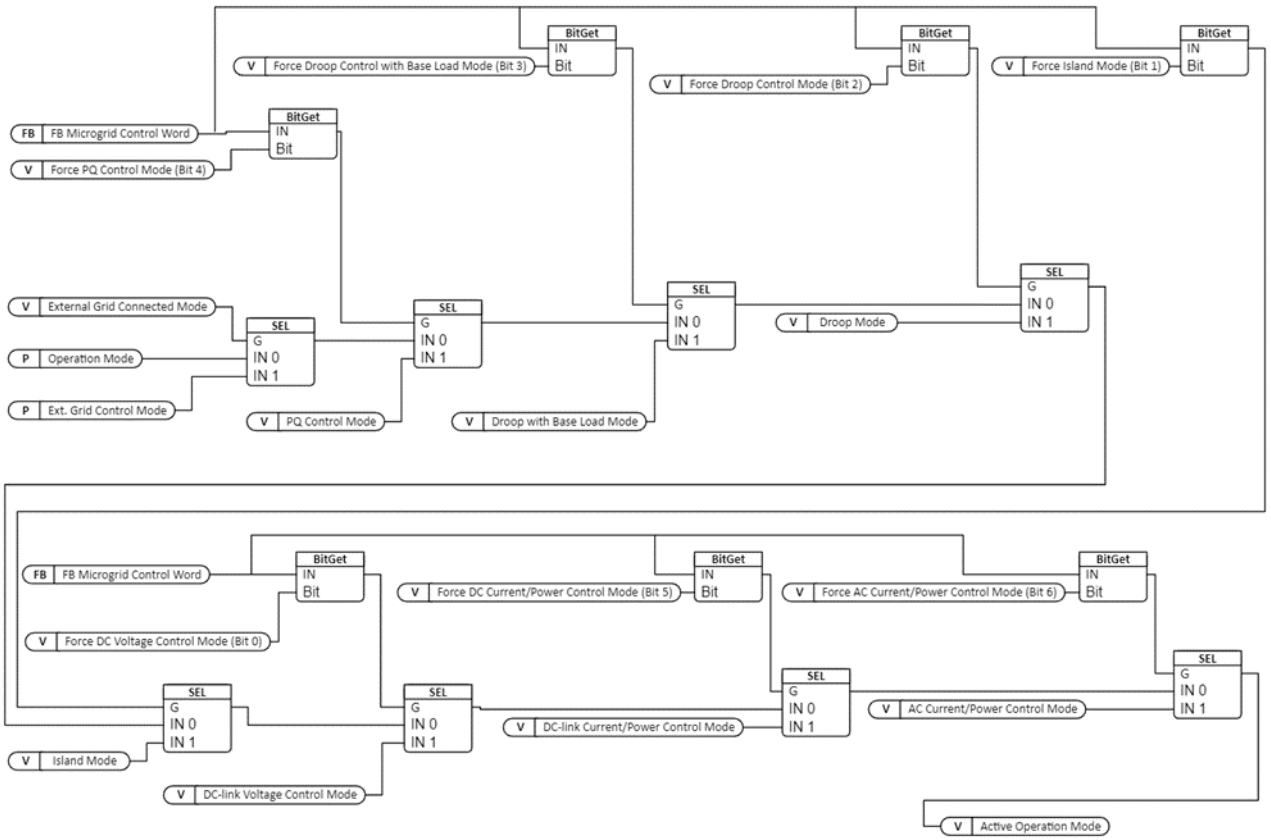


Figure 17: Advanced droop curve

3.5 Control Mode Prioritization

The handling of operation mode through FB Microgrid Control Word (No. 1500) takes priority over the selection made through parameter Operation Mode (No. 161). As shown in the following figure, the bits ranging from 0 to 6 of FB Microgrid Control Word (No. 1500) will override the preceding mode, therefore forcing the final operation mode to shift accordingly. More details about force operation mode priority through Microgrid Control Word and the respective bit description can be find in section 4.4.3.



3.6 DC-Link Overvoltage and Undervoltage Control

The availability of DC-link overvoltage and undervoltage controls is outlined in Table 3. They prevent DC-link voltage going out of range due to mismatches in power demand and delivery. The overvoltage and undervoltage controllers can be enabled separately. When enabled, the control starts when the actual voltage exceeds the activation limit and tries to limit the input/output power by changing the frequency to keep the DC voltage within limits. The limits can be given by parameter or through the fieldbus. The parameters of overvoltage and undervoltage controllers are given in percentage of internal default values. The DC voltage control mode (AFE) controls the DC-link voltage in a closed loop and therefore separate minimum and maximum controllers are not used.

Droop control can be used to ensure load sharing between parallel-connected converters with individual control units when voltage limiting control is active. The droop gain defines the percentage of the voltage limit level change as a function of the percentage of the current. The filter time constant for active current used in drooping can be parametrized. The parameters are the same that are used for DC-link voltage droop control in DC voltage control mode.

Multiple regulators can be active simultaneously and their statuses are shown in the Limit Control Status Word. Note: the activation of a limit controller (overvoltage, for example) immediately after start is not prohibited, unlike in typical motor control applications.

3.7 Current Limits and Short-Term Current Injection

Grid Converter has two current limits: normal grid current limits and short-term current injection limits. The former is for controlling current in normal operating conditions, and the latter for activating protective devices during a short circuit event in the grid. The short-term current limit is higher than the normal current limit and is available for a limited time (some seconds). The short-term current limit is defined with parameter ***Short Term Current Limit (No. 2867)***.

The limits are hardware specific. The normal current limit is active in all control modes. The short-term current injection limit is available only in island, droop, droop with base load, and PQ control modes, as illustrated in the following table:

Table 5: Current limits in control modes

Operation mode	Short-term current limit	Positive active current limit	Negative active current limit	Current limit
Island	X	X	X	X
Droop control (Micro-grid mode)	X	X	X	X
Droop control with base load	X	X	X	X
PQ control	X	X	X	X
DC voltage control (AFE control)		X	X	X
AC current or power control		X	X	X
DC current or power control		X	X	X

The short-term current injection capability is illustrated in Figure 18. It enables the Grid Converter to supply intermittent current above the normal current limit. This way the converter can, for example, supply short circuit current to trigger protective devices, so that the selectivity and correct operation of the system protection can be guaranteed. During a short-term current injection event, the converter supplies current against an elevated current limit until the fault is cleared, or the pre-defined injection time is exceeded. If the grid fault is cleared, normal operation continues without interruption. If the fault is not cleared within the pre-defined time, it triggers the ShortTermCurrent Injection fault (0x21FF). This feature is enabled by default, but if required, it can be disabled with parameter ***Short Term Current Enabled (No. 2873)***. By default, the active current limits can also be adjusted internally based on the grid frequency. This function can be disabled with parameter ***Enable Freq. Based Current Limit (No. 2343)***.

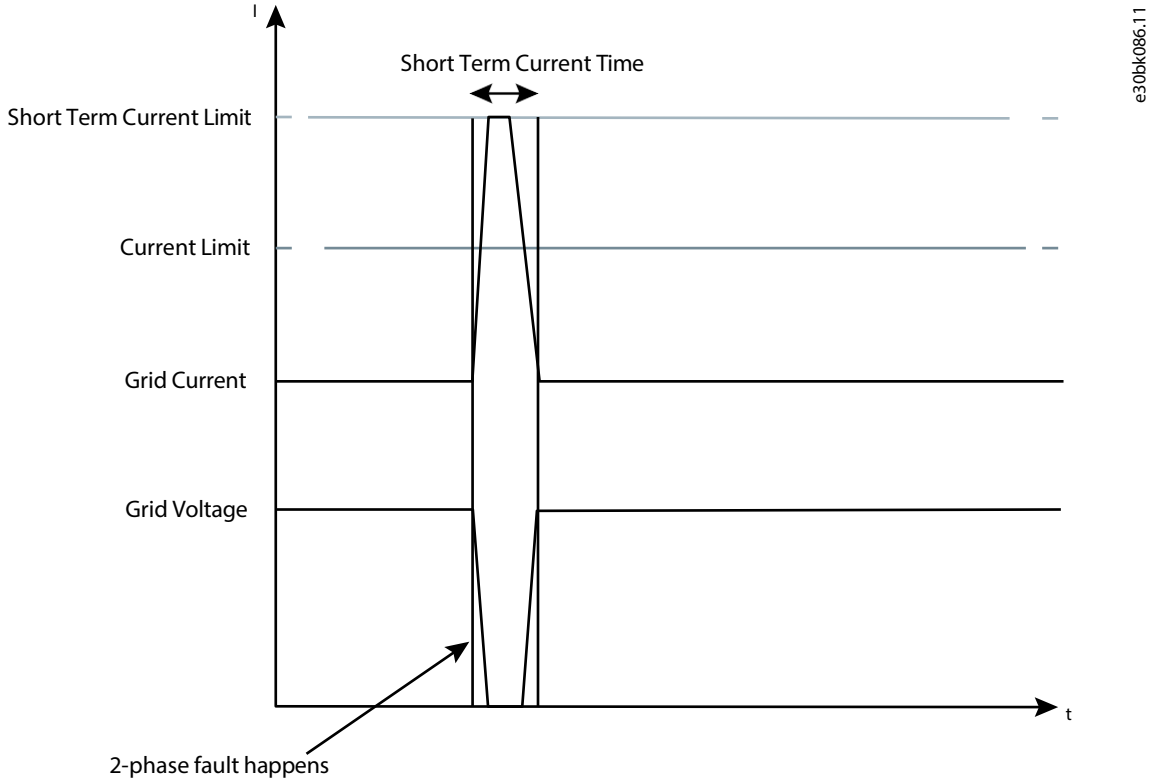


Figure 18: A short-term current injection during a short circuit in the microgrid

3.8 Grid Supervision

The grid supervision feature provides grid voltage and frequency supervision. Grid supervision includes overvoltage, undervoltage, high frequency, and low frequency supervision.

3.8.1 Overvoltage Supervision

Overvoltage supervision monitors the grid voltage when the converter is running. If the grid voltage percentage exceeds parameter ***Grid Overvoltage Warning Limit (No. 252)*** for the duration of parameter ***Grid Overvoltage Fault Delay (No. 254)***, it triggers a warning. Once the warning limit has been reached, the triggering condition for the warning remains active as long as the voltage is higher than ***Grid Overvoltage Warning Limit (No. 252)*** minus ***Grid Volt. Supervision Hysteresis (No. 251)***.

If the grid voltage percentage exceeds parameter***Grid Overvoltage Delayed Fault Limit (No. 250)*** for the duration of parameter ***Grid Overvoltage Fault Delay (No. 254)***, it triggers a fault, and the converter is stopped. Once the fault limit has been reached, the triggering condition for the fault remains active as long as the voltage is higher than ***Grid Overvoltage Delayed Fault Limit (No 250)*** minus ***Grid Volt. Supervision Hysteresis (No. 251)***.

If the grid voltage percent exceeds parameter ***Grid Overvoltage Instant Fault Limit (No. 2842)***, it triggers a fault instantaneously, and the converter is stopped.

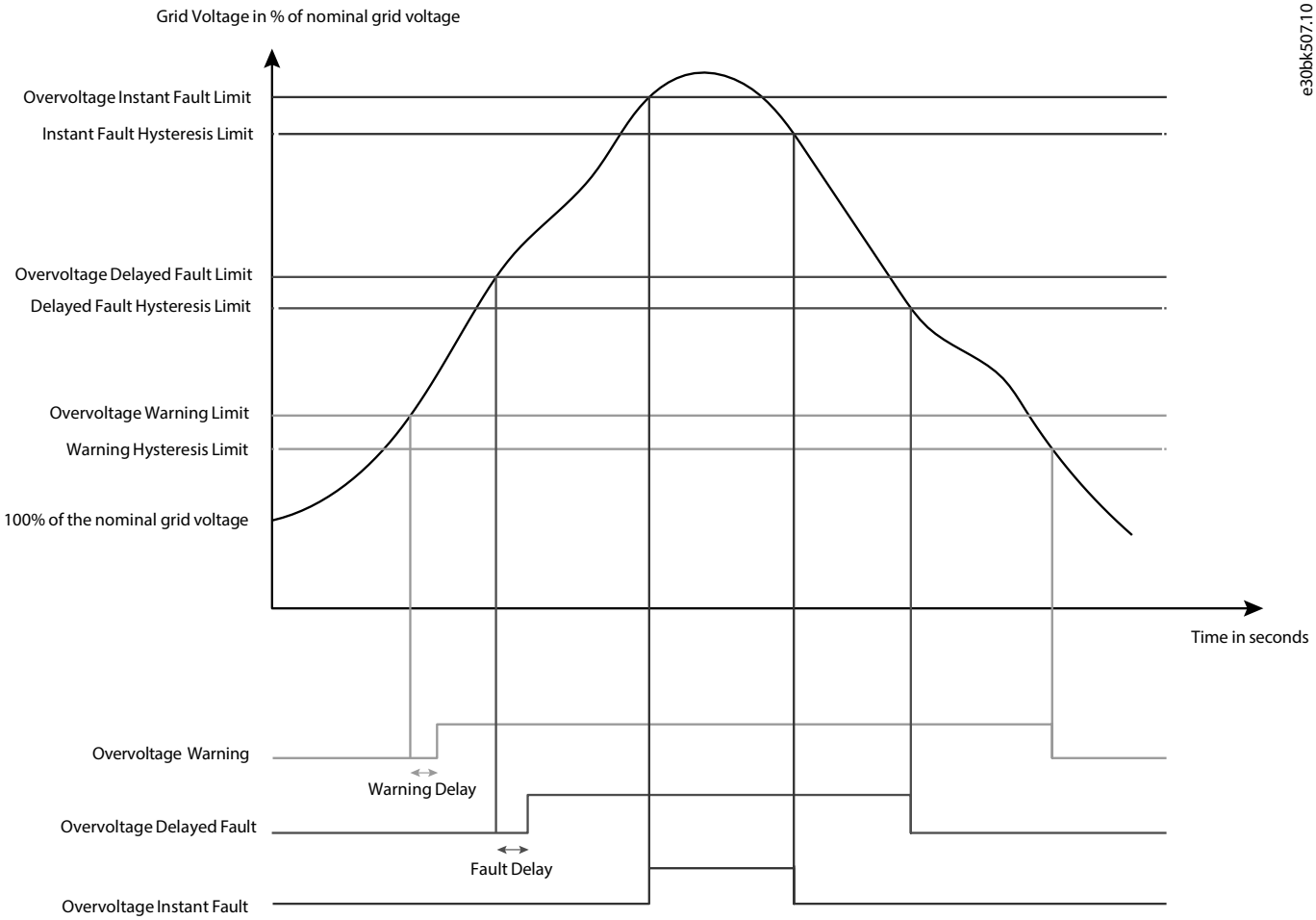


Figure 19: Grid Overvoltage Supervision

3.8.2 Undervoltage Supervision

Undervoltage supervision monitors the grid voltage when the converter is running. If the grid voltage percentage becomes lower than parameter ***Grid Undervoltage Warning Limit (No. 253)*** for the duration of parameter ***Grid Undervoltage Fault Delay (No. 263)***, it triggers a warning. Once the warning limit has been reached, the triggering condition for the warning remains active as long as the voltage is lower than ***Grid Undervoltage Warning Limit (No. 253)*** plus ***Grid Volt. Supervision Hysteresis (No. 251)***.

If the grid voltage percentage becomes lower than parameter ***Grid Undervoltage Delayed Fault Limit (No. 262)*** for the duration of parameter ***Grid Undervoltage Fault Delay (No. 263)***, it triggers a fault, and the converter is stopped. Once the fault limit has been reached, the triggering condition for the fault remains active as long as the voltage is lower than***Grid Undervoltage Delayed Fault Limit (No 262)*** plus ***Grid Volt. Supervision Hysteresis (No. 251)***.

If the grid voltage percentage becomes lower than parameter ***Grid Undervoltage Instant Fault Limit***, it triggers a fault instantaneously, and the converter is stopped.

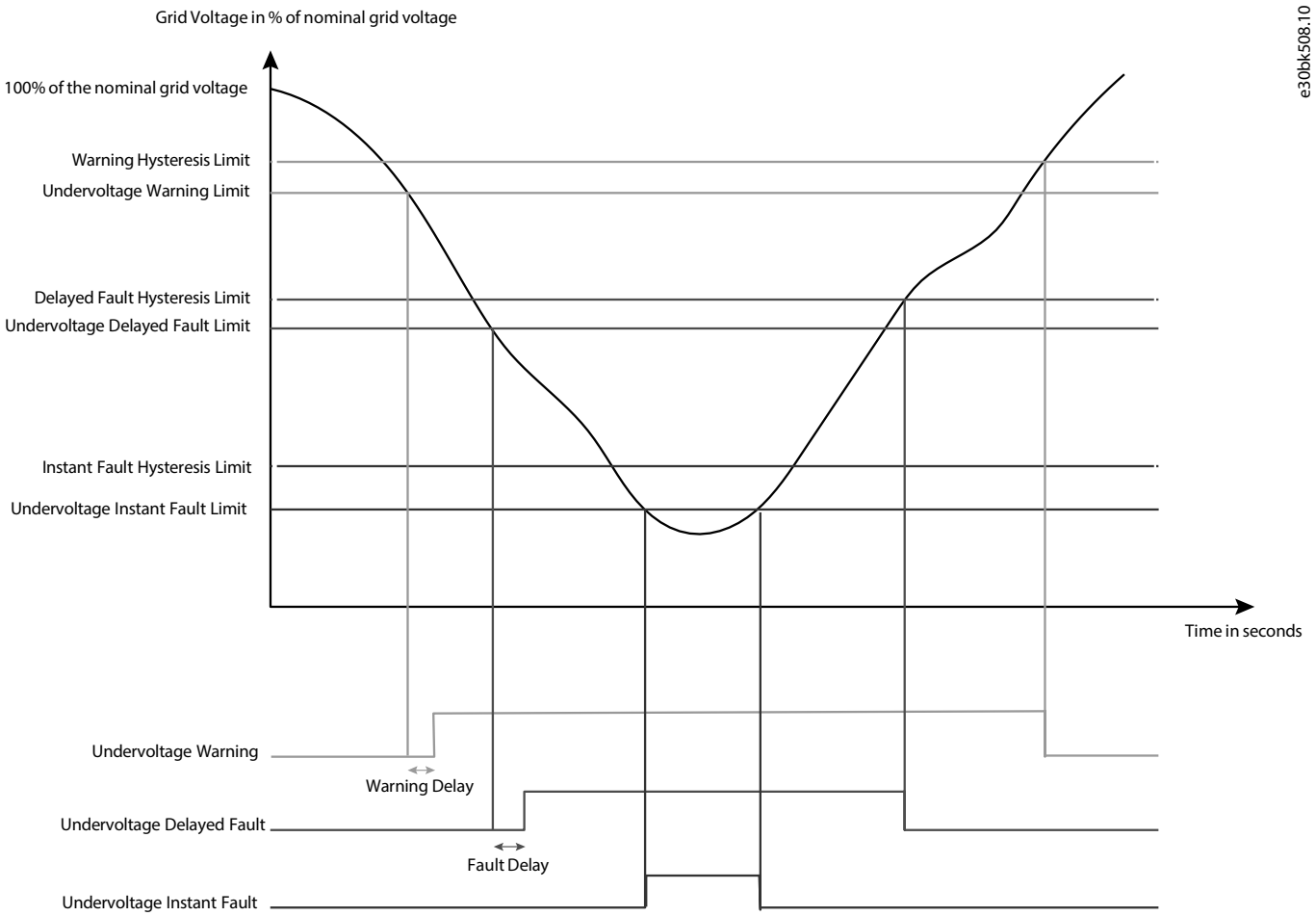


Figure 20: Grid Undervoltage Supervision

3.8.3 High Frequency Supervision

High frequency supervision monitors the grid frequency when the converter is running. If the grid frequency exceeds parameter ***High Freq. Warning Limit (No. 257)*** for the duration of parameter ***High Freq. Fault Delay (No. 260)***, it triggers a warning. Once the warning limit has been reached, the triggering condition for the warning remains active as long as the frequency is higher than ***High Freq. Warning Limit (No. 257)*** minus ***Freq. Supervision Hysteresis (No. 256)***.

If the grid frequency exceeds parameter ***High Freq. Delayed Fault Limit (No. 255)*** for the duration of parameter ***High Freq. Fault Delay (No. 260)***, it triggers a fault, and the converter is stopped. Once the fault limit has been reached, the triggering condition for the fault remains active as long as the frequency is higher than ***High Freq. Delayed Fault Limit (No. 255)*** minus ***Freq. Supervision Hysteresis (No. 256)***.

If the grid frequency exceeds parameter ***High Freq. Instant Fault Limit (No. 2840)***, it triggers a fault instantaneously, and the converter is stopped.

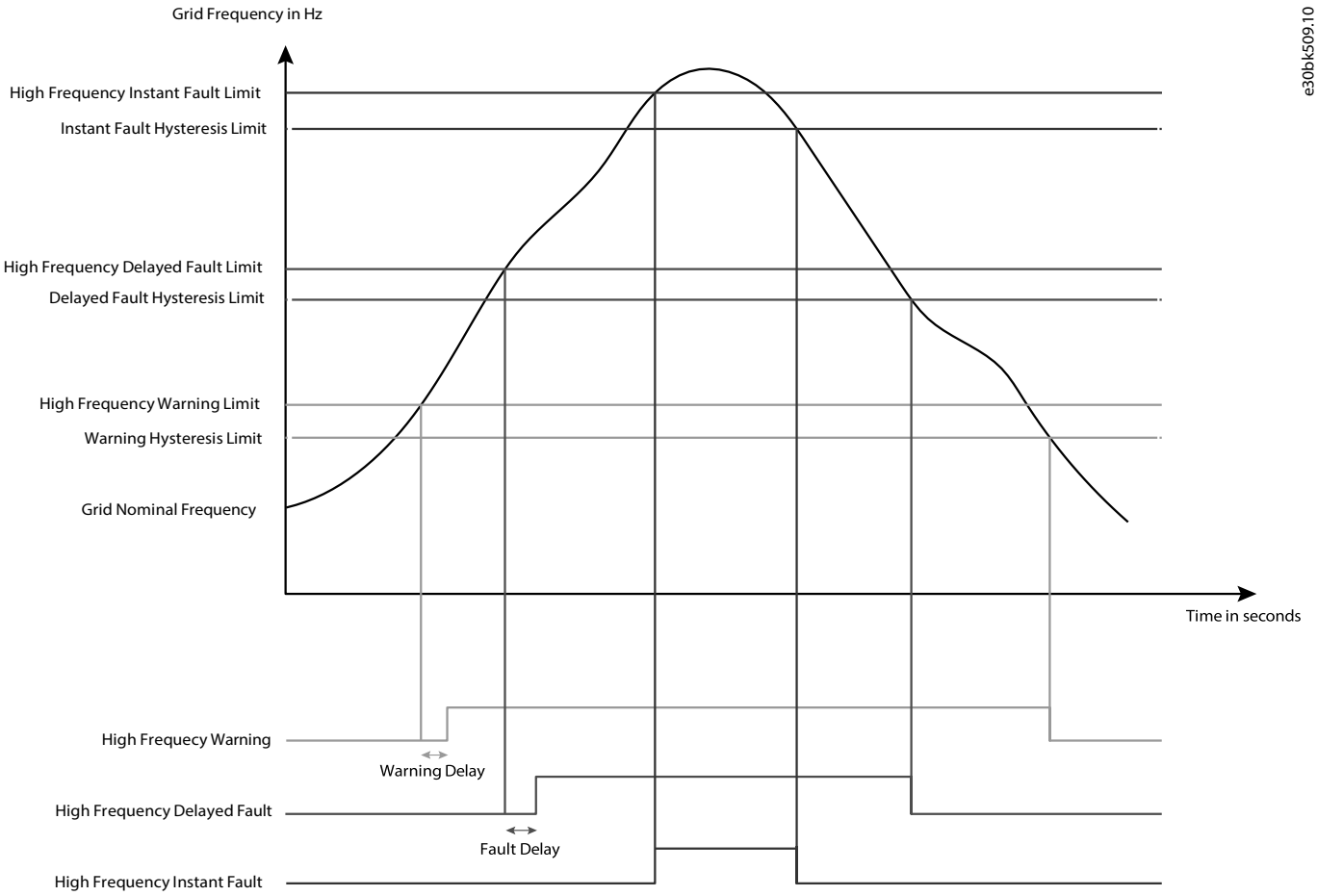


Figure 21: Grid High Frequency Supervision

3.8.4 Low Frequency Supervision

Low frequency supervision monitors the grid frequency when the converter is running. If the grid frequency becomes lower than parameter ***Low Freq. Warning Limit (No. 259)*** for the duration of parameter ***Low Freq. Fault Delay (No. 261)***, it triggers a warning. Once the warning limit has been reached, the triggering condition for the warning remains active as long as the frequency is lower than ***Low Freq. Warning Limit (no. 259)*** plus ***Freq. Supervision Hysteresis (No. 256)***.

If the grid frequency becomes lower than parameter ***Low Freq. Delayed Fault Limit (No. 258)*** for the duration of parameter ***Low Freq. Fault Delay (No 261)***, it triggers a fault, and the converter is stopped. Once the fault limit has been reached, the triggering condition for the fault remains active as long as the frequency is lower than ***Low Freq. Delayed Fault Limit (No. 258)*** plus ***Freq. Supervision Hysteresis (No. 256)***.

If the grid frequency becomes lower than parameter ***Low Freq. Instant Fault Limit (No. 2841)***, it triggers a fault instantaneously, and the converter is stopped.

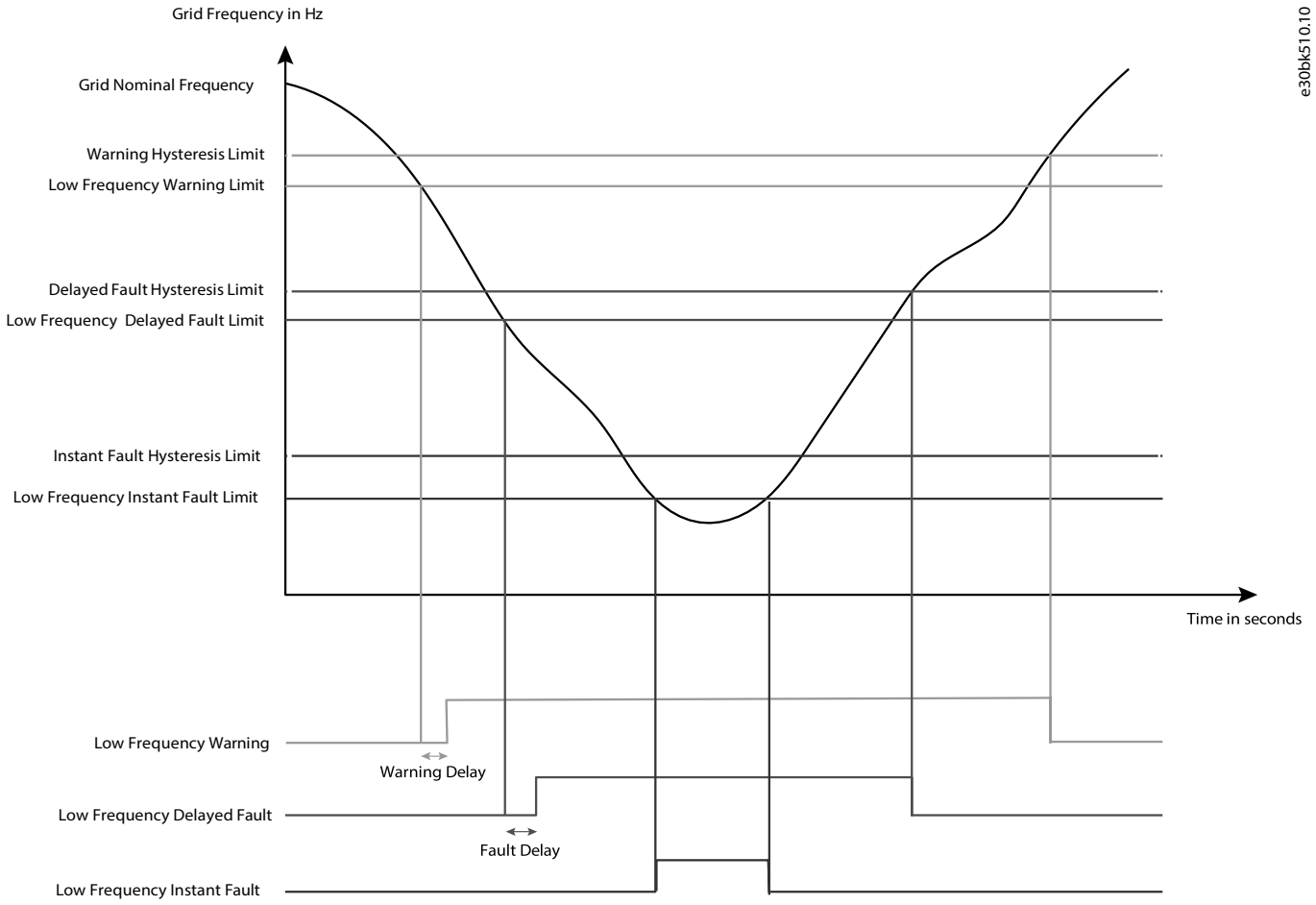


Figure 22: Grid Low Frequency Supervision

3.9 Digital Potentiometer for Grid Frequency and Voltage Reference

3.9.1 Grid Frequency Potentiometer

A digital potentiometer is used to adjust the grid frequency reference and it has inputs to increase and decrease the reference based on grid load. A reset function provides the possibility to reset the digital potentiometer, and allows a zero active power start for the grid converter. There are four different inputs for digital potentiometer reset, and each has its own action.

The reset action can be selected with the parameter ***Freq. Ref. Reset Stop State Value (No. 5059)*** when the converter is in stop state. When the control mode is DC voltage control (AFE), the reset action can be selected with the parameter ***Freq. Ref. Reset AFE Mode Value (No. 5061)***. The digital input ***Freq. Reset Input (No. 5055)*** can also be used as reset input, and the reset action is selected using ***Freq. Ref. Reset I/O Value (No. 5060)***. For all three reference reset conditions, the following reset actions can be selected:

Table 6: Reset Actions

Selection	Action
0	No action
1	Reset to Grid Nominal
2	Reset to Grid Actual

The digital potentiometer reset can also be done using the fieldbus. Using the fieldbus, the reset command is given with the default bit 9 of the ***FB Microgrid Control Word***. The reset action is selected with the default bit 13 of the ***FB Microgrid Control Word***.

Table 7: Fieldbus Default Bits

Bit number	Description
9	0: Frequency reference reset is not active. 1: Frequency reference reset is active.
13	0: When bit 9 is high, reset frequency reference to grid nominal. 1: When bit 9 is high, reset frequency reference to grid actual.

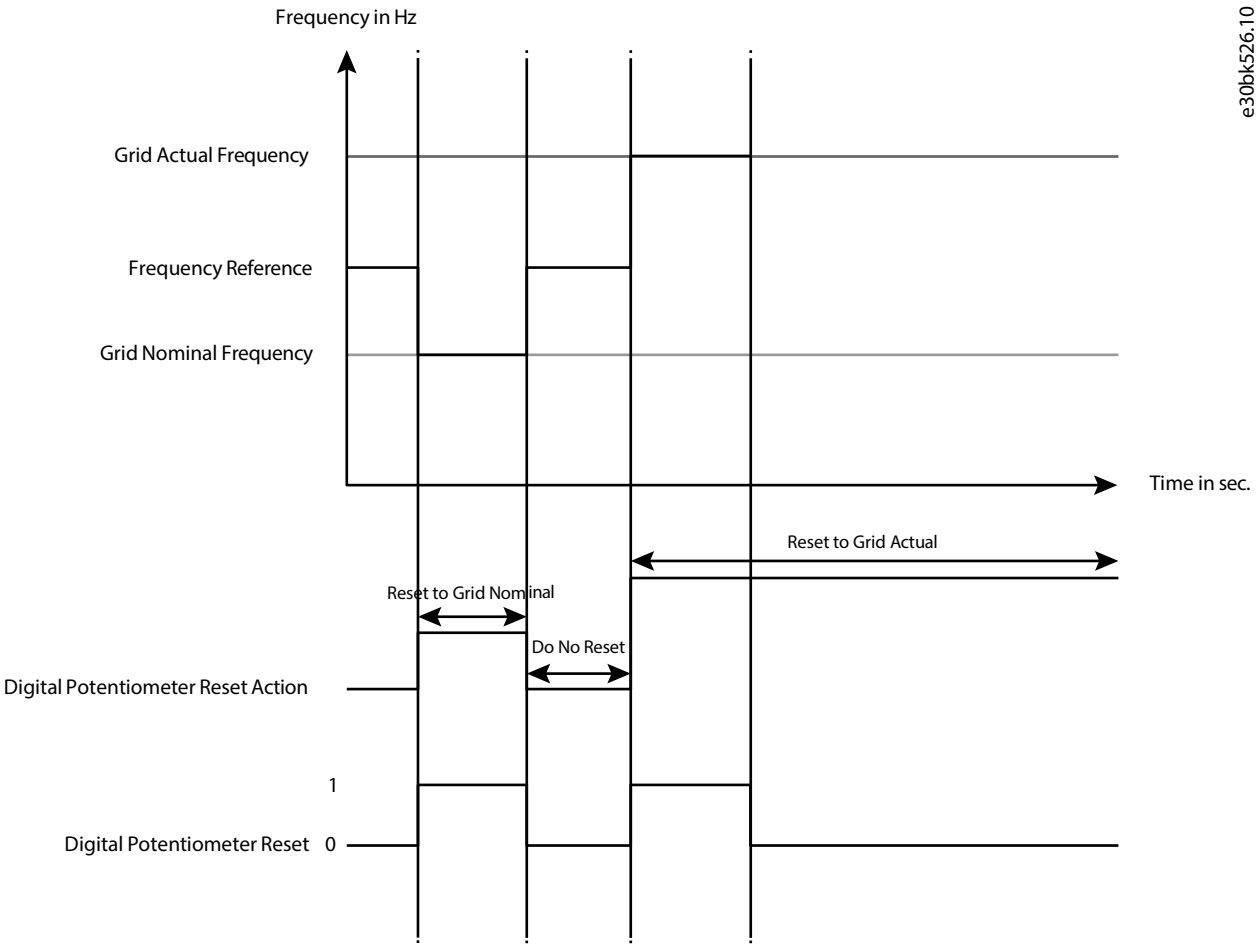


Figure 23: Grid Frequency Reset Actions

3.9.2 Grid Voltage Potentiometer

Voltage reference is used to control the Grid Converter output voltage as a percentage of the nominal grid voltage. The reference is adjusted with a digital potentiometer. It has inputs to increase and decrease the reference based on grid load. The digital potentiometer can be reset to allow a zero reactive power start for the grid converter. There are 4 different inputs for digital potentiometer reset, and each input has its own action.

The reset action can be selected with the parameter ***Voltage Ref. Reset Stop State Value (No. 5075)*** when the converter is in stop state. When the control mode is DC-link voltage control (AFE), the reset action can be selected with the parameter ***Voltage Ref. Reset AFE Mode Value (No. 5077)***. The digital input ***Voltage Reset Input*** can also be used as reset input, and the reset action is selected using ***Voltage Ref. Reset I/O Value (No. 5076)***. For all three reference reset conditions, the following reset actions can be selected:

Table 8: Reset Actions

Selection	Action
0	No action
1	Reset to Grid Nominal
2	Reset to Grid Actual

The digital potentiometer reset can also be done using the fieldbus. Using the fieldbus, the reset command is given with the default bit 12 of the ***FB Microgrid Control Word***. The reset action is selected with the default bit 14 of the ***FB Microgrid Control Word***.

Table 9: Fieldbus Default Bits

Bit number	Description
12	0: Frequency reference reset is not active. 1: Frequency reference reset is active.
14	0: When bit 12 is high, reset frequency reference to grid nominal. 1: When bit 12 is high, reset frequency reference to grid actual.

3.10 Paralleling Grid Converters

Paralleling refers to a system in which multiple Grid Converters are connected to the same DC bus or to the same AC bus or microgrid. Several power units can operate under one control unit using a star coupler board, and this configuration is considered a single Grid Converter from the system level point of view. *Grid Converter Design Guide* describes the technical considerations for paralleling in depth, and the electrical system designer must refer to it when designing a paralleled system. Typical paralleling configurations are illustrated in the following figure.

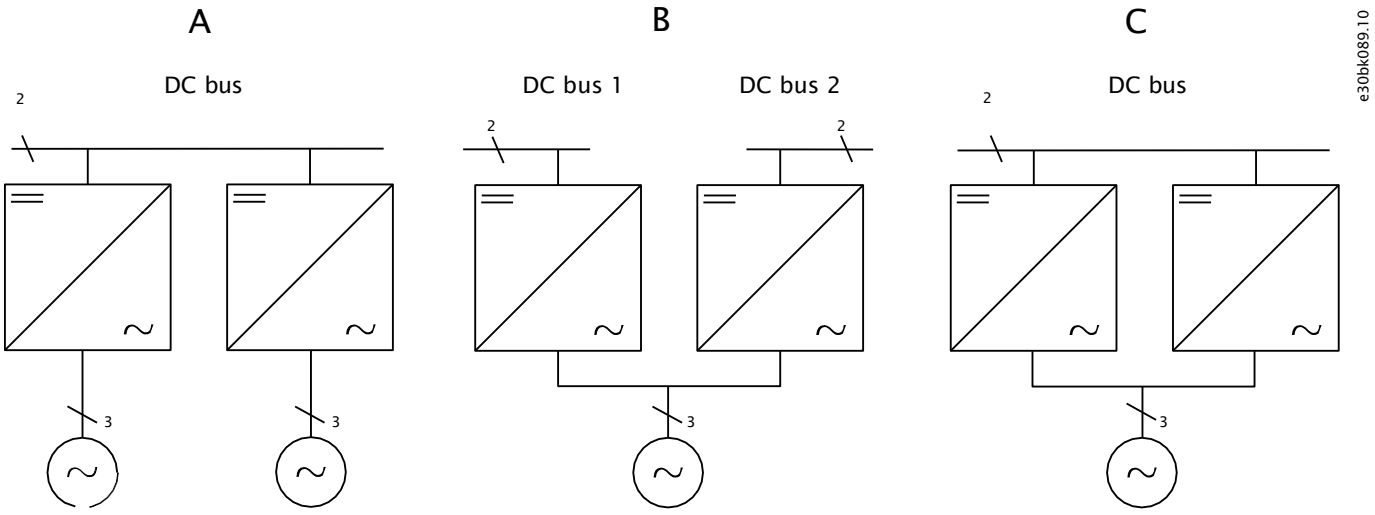


Figure 24: Topologies: A) Common DC bus B) Common AC grid C) Common DC bus and AC bus D) Same as topology C, but the converters have their own transformers

Table 10: Paralleled grid converters

	A: Common DC bus	B: Common AC grid	C: Common DC bus and AC grid	D: Common DC bus and AC grid with transformers
DC voltage control (or undervoltage/ overvoltage controller)	DC voltage droop		Paralleling synchronization mode enabled: DC voltage droop Same switching frequency Same reactive reference Same modulator type	This can be considered the same as option A
Droop control (Microgrid mode)		AC voltage and frequency droop	Paralleling synchronization mode enabled: DC voltage and frequency droop Same switching frequency Same modulator type	
AC/DC power/ current and droop control base load control modes			Paralleling synchronization mode enabled: Same references for all converters Same switching frequency Same modulator type	

3.10.1 Drooping When Paralleling with a Common DC-Link

Drooping is available for DC-link voltage control and DC-link undervoltage and overvoltage control. It enables load sharing between parallel converters with individual control units and without the need for grid converter-to-grid converter communication. The droop modifies the reference voltage as a function of the output current. The full output current is never provided when the controlled voltage is at the reference. This guarantees that the integral action of the voltage controllers does not lead to uneven load sharing due to voltage measurement tolerances. Instead, the converters share the load autonomously independent of the number of parallel converters.

The droop gain k, or the slope, is defined as the ratio of voltage change to active current change, as follows: $k= \Delta V(\%)/\Delta I(\%)$

where

k = droop gain

$\Delta V(\%)$ = change in controlled voltage, in percentage

$\Delta I(\%)$ = change in controlled current, in percentage

The final voltage reference modified by the droop is: V_{ref},final(%) = $V_{ref}(\%) - kI(\%) = V_{ref}(\%) - \Delta V_{ref}(\%)$

where

V_{ref} (%) = the given voltage reference percentage

$\Delta V_{ref}(\%)$ = the effect of the droop in the reference

ΔV_{ref},final(%) = the final reference, affected by the droop

The droop slope produced on the reference is shown in the following figure when k = 4.

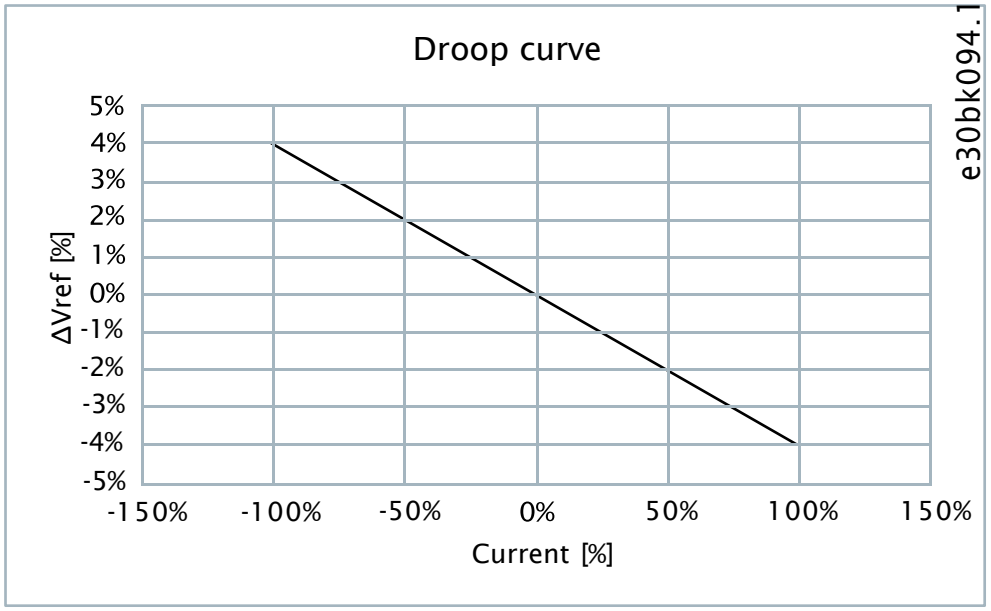


Figure 25: Example of droop with k = 4

If the voltage must stay unchanged regardless of the load, a secondary control system (typically a power management system) is required to monitor the load or voltage and adjust the common voltage reference to all units. For example, in a system where droop is set according to _ the voltage decreases by 4% when the load current is 100%. To maintain the voltage in the original reference, the upper control system monitors the system, and in this case increases the voltage reference by 4% for all parallel units.

This behavior is exemplified in _. The points A-B-C-D describe the behavior with positive current, and A-E-F-G with negative current. In the beginning, the operating point is A with no load. Next, the current increases to 100% positive output, the operating point moves to B, and the voltage reference is offset by –4%. The upper control compensates for the droop effect by increasing the centralized voltage reference given to all voltage controlling units and the operating point moves to C. If the system is unloaded, the operating point moves from C to D and the upper control must adjust the centralized reference to return the system back to the desired voltage. The points A-E-F-G-A illustrate the behavior in the case of negative current.

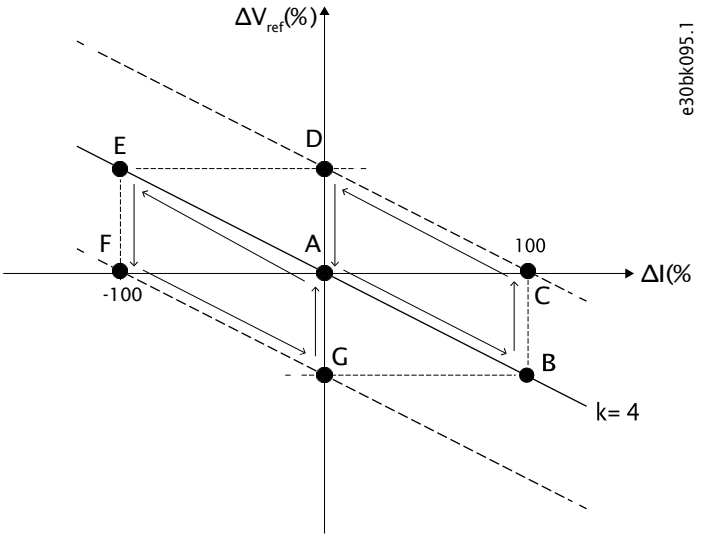


Figure 26: Drooping and the compensation of the offset by secondary control

When DC-link voltage drooping is enabled, the DC voltage decreases as a function of the load current. The DC voltage reference and drooping gain are set so that the minimum boost requirement is satisfied. For example, if the minimum boost is set to 102% and the drooping is set to 3%, the DC voltage reference is set to 106% to cover the 110% overload.

3.11 THD(u) Compensation

The Voltage harmonic distortion (THDu) compensation feature reduces voltage distortion in the grid caused by non-linear loads such as motor drives with 6-pulse rectifiers. Non-sinusoidal currents cause voltage drop across the system impedances such as the supply transformer. Poor voltage quality increases losses in the system and may cause malfunction in some equipment connected to the grid. The Grid Converter compensates selected harmonics in the voltage and aims to produce a sinusoidal voltage based on voltage measured by the OC7V0 Voltage Measurement option.

This feature is intended only for grid forming applications where Grid Converter is the only voltage source in the local microgrid. A transformer is required between the Grid Converter and the load. Voltage measurement is required as illustrated in Figure 2.

To enable this feature, set parameter ***Harmonic Compensation Mode (No. 4998)*** to following:

1. Voltage Harmonic Compensation (Reduced).

   Compensation of the 5^{th}, 7^{th}, 11^{th}, and 13^{th} harmonics only.

2. Voltage Harmonic Compensation (Full)

   Compensation of the 5^{th}, 7^{th}, 11^{th}, 13^{th}, 17^{th}, and 19^{th} harmonics only.

By default, ***Harmonic Compensation Mode (No. 4998)*** is set to Off state. One of the prerequisites for enabling the feature is to have the OC7V0 option board, and to have one of the two channels (X52 or X53) of the AC Mains Voltage Measurement OC7V0 option being used to sense the AC voltage with parameter ***Grid Voltage Feedback Source (No. 6539)***. The voltage harmonic compensation is deactivated during Short Term Current Injection (STCI) and DC-Link Limit Control (Over and Undervoltage) situations.

The voltage harmonics compensation feature impacts system voltage selection and the dimensioning of the converter. Refer to the iC7 Series Liquid-cooled System Modules Design Guide for details.

NOTICE

The THDu compensation feature currently only supports grid forming modes. It is crucial to consult with Danfoss before enabling or altering this feature to ensure compatibility and safety in your specific application environment. Contact Danfoss support or your local representative for guidance on enabling this feature and to confirm that it meets the specific requirements of your electrical system.

3.12 Transformer-Interactive Control

A power transformer between Grid Converter and the load is used to step the voltage up or down, or to create galvanic isolation. In addition, the transformer eliminates DC current injection and can block the propagation of zero-sequence voltage (depends on vector group and grounding). When the transformer is loaded, it produces a voltage drop across the transformer impedance. In microgrid systems, it is beneficial to compensate for the voltage drop of the transformer to provide regulated voltage for the loads and consumers. Grid Converter provides both sensored and semi-sensorless methods for transformer compensation. The sensored compensation is based on taking the voltage measurement from the load side of the transformer. Closed loop control enables accurate compensation of the voltage drop. The system supports the use of an auxiliary voltage measurement transformer in case the load side voltage is out of range of the Voltage Measurement OC7V0 option. The semi-sensorless method uses the transformer electrical data and the inverter measurements to compensate for the voltage drop. It is useful when the load side voltage measurement is not available.

The transformer-interactive control expects the parameterization of Grid Converter per the electrical characteristics of the transformer. The converter (V1) and load (V2) winding voltages and their phase displacement are parameterized to account for the turns ratio and vector group. The phase displacement is defined in degrees, –180°...180° of the converter side voltage phase difference to the load side voltage. The leading phase difference has a positive sign and a lagging negative sign as per the clock face notation. The same convention applies to both the main and measurement transformer parameters. The electrical characteristics of the main transformer are configured per product label values for nominal apparent power (kVA), nominal frequency (Hz), short circuit impedance (%), and nominal load losses

(kW). The electrical values are used by the transformer-interactive control to compensate for the voltage drop across the transformer impedance.

Figure 27 gives examples on the winding configurations and the phase differences. The phase difference is expressed as the phase shift of the secondary winding (lowercase letter) to the primary winding (capital letter). For example, in the Dyn11 winding configuration, the secondary wye leads the primary delta by +30°. In the clock face notation, the primary-side line to the neutral voltage of terminal A is oriented to 12 o'clock. The phase lead of the secondary is considered a counterclockwise voltage phasor rotation. Hence the 30° lead of the secondary wye results in the line to neutral a-terminal voltage pointing towards 11 o'clock.

The grid nominal voltage and current parameters define the transformer load side quantities when the transformer parameters are commissioned. Grid Converter adapts the converter side voltage to the transformer turns ratio to produce the requested voltage on the load side. All references and monitoring values are referenced to the load side (grid side) of the transformer.

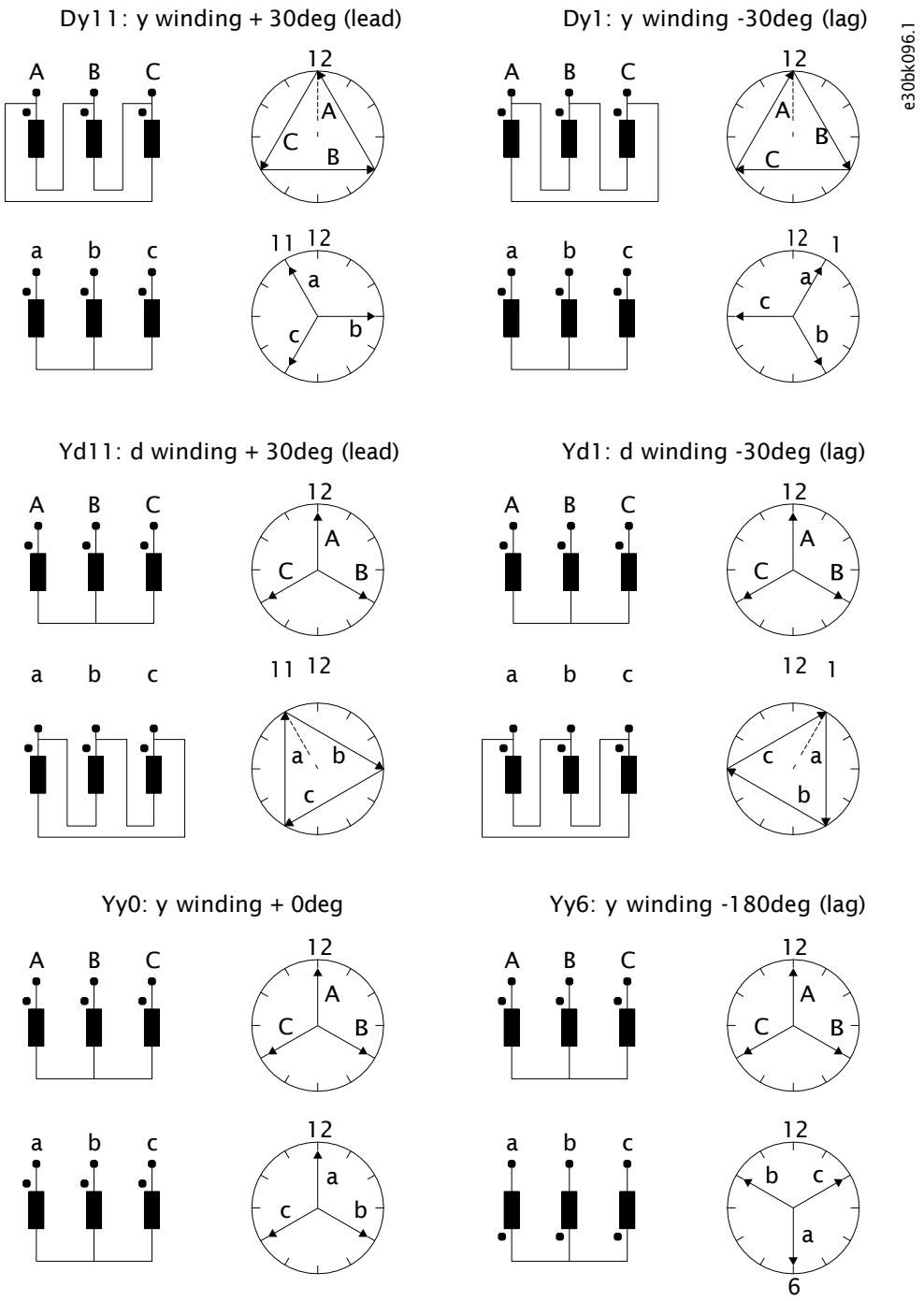


Figure 27: Examples of transformer vector groups and the phase difference between the winding voltages

Table 11: Transformer winding configuration and phase shift

Connection			Phase shift	Clock number
Yy0	Dd0	Dz0	0	0
Yd1	Dy1	Yz1	-30	1
	Dd2	Dz2	-60	2
	Dd4	Dz4	-120	4
Yd5	Dy5	Yz5	-150	5

Table 11: Transformer winding configuration and phase shift *(continued)*

Connection			Phase shift	Clock number
Yy6	Dd6	Dz6	-180	6
Yd7	Dy7	Yz7	150	7
	Dd8	Dz8	120	8
	Dd10	Dz10	60	10
Yd11	Dy11	Yz11	30	11

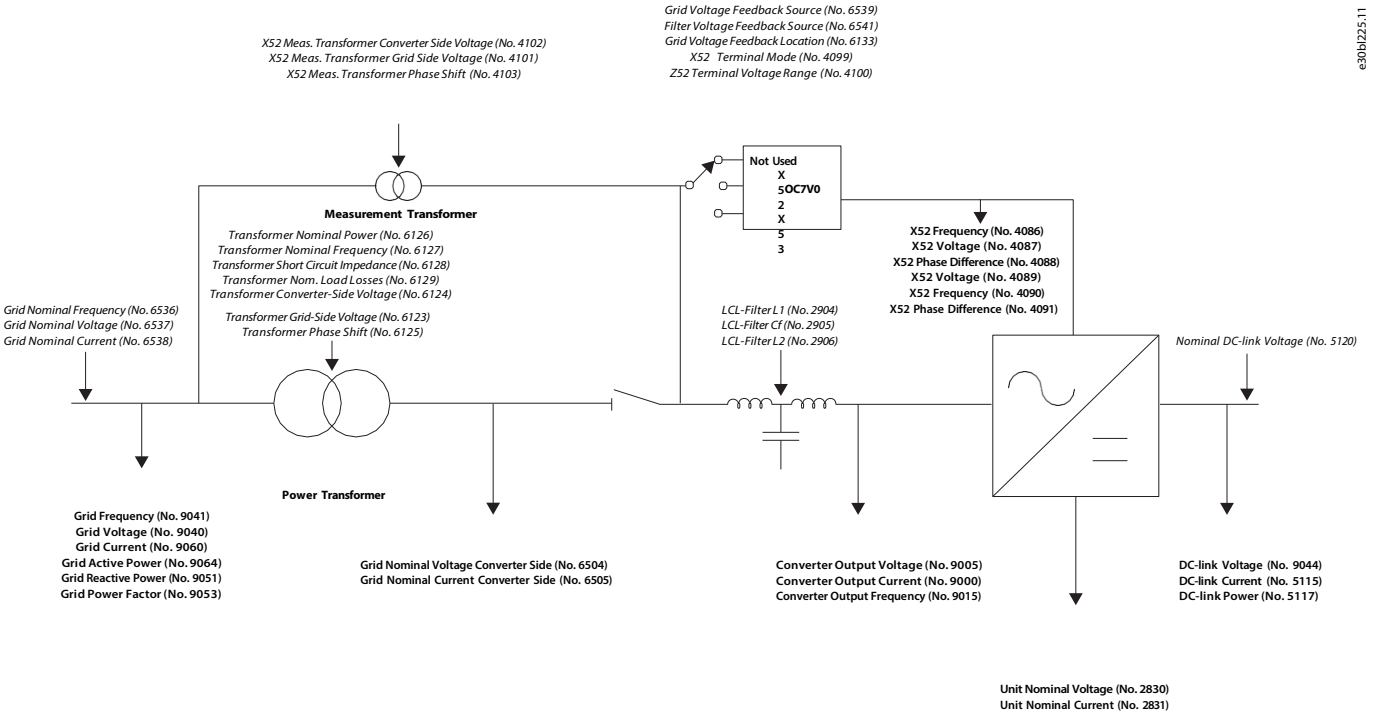


Figure 28: Transformer interactive control schematic

The transformer grid or converter side voltage refers to the turn ratio of the transformer (that is, the product label winding voltages) and not the actual voltages in the installation. If an LC-filter is installed, the L2 must be set to 0, and the Grid Converter calculates the L2 value internally using the transformer short circuit impedance.

3.13 Black Start and Blackout Prevention

The black start capability is available in grid-forming control modes: island, droop, and droop with base load. If an unenergized network is detected when the converter is started, the converter ramps up the voltage from zero to the specified setpoint. This way the power system lines, transformers, and other equipment are energized in a controlled manner. The load pick-up capability depends on the sizing of the converter system.

The blackout prevention capability is available in droop control schemes which support operation in parallel with other grid-forming units. The converter can stay in operation to supply the loads if the other generating units are disconnected, for example in power systems on board ships.

3.14 Mains Voltage Sensorless and Sensored Operation

Grid Converter can operate in all available control modes without the Mains Voltage Measurement OC7V0 option. In sensorless mode the voltage drop across the line filter and main transformer can be compensated by configuring the filter and transformer parameters. The extended Grid Converter features are available when the two-channel AC Mains Voltage Measurement OC7V0 option is used.

3.14.1 Line Filter Energization and Transformer Magnetization

Grid Converter can charge the filter capacitors, magnetize transformers, and synchronize to the voltage measured from the other side of the main circuit breaker. This way the inrush currents and voltage transients typically occurring after the breaker closes are effectively avoided.

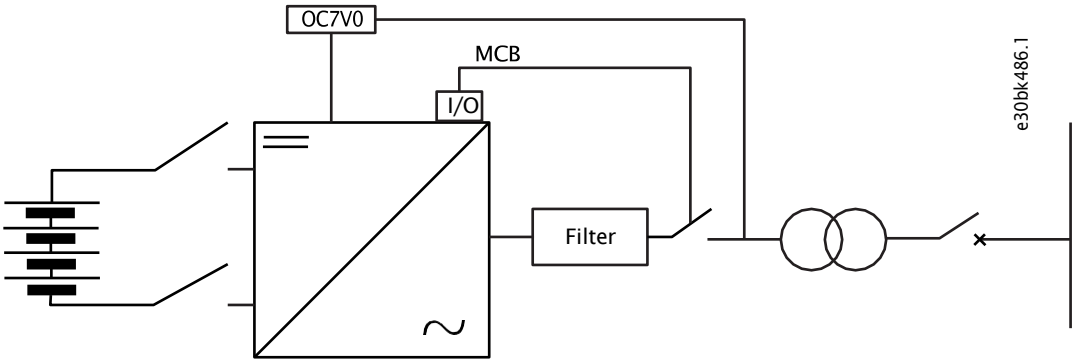


Figure 29: Line filter energization and transformer magnetization

3.14.2 Closed Loop AC Voltage Control

The Grid Converter control can be oriented to different network nodes by using the Mains Voltage Measurement OC7V0 option board. For example, the voltage can be measured upstream of the line filter or the main transformer. The measurement point is configured in the application with a parameter. An auxiliary voltage measurement transformer can be used to step down the voltage to the input range of the option board OC7V0. This way the measurement can be taken from the medium voltage. The closed loop control compensates for voltage losses across the transformer impedance when the measurement is from the load side. Open loop transformer voltage drop compensation is available when the feedback is from the converter side.

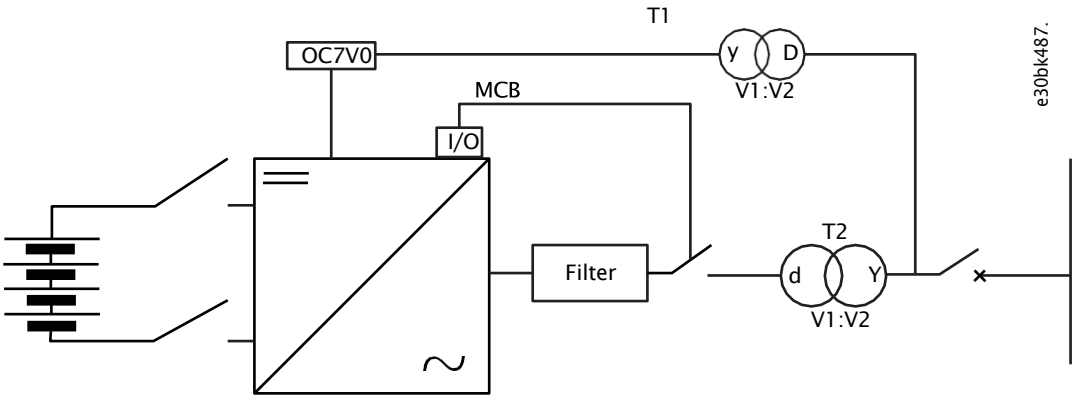


Figure 30: Closed loop AC voltage control

3.15 External Grid Synchronization

Grid synchronization allows Grid Converter to operate as a microgrid converter or as a grid-connected converter, and change between these two operating modes on-the-fly based on the grid connection state.

A typical configuration with the external grid synchronization functionality is illustrated in the following figure. When the external grid contactor is open, the converter operates in island or droop mode, and when an external grid is connected the operating mode is changed to DC-link Voltage (AFE) or Grid Converter can continue operation in the grid forming or supporting modes.

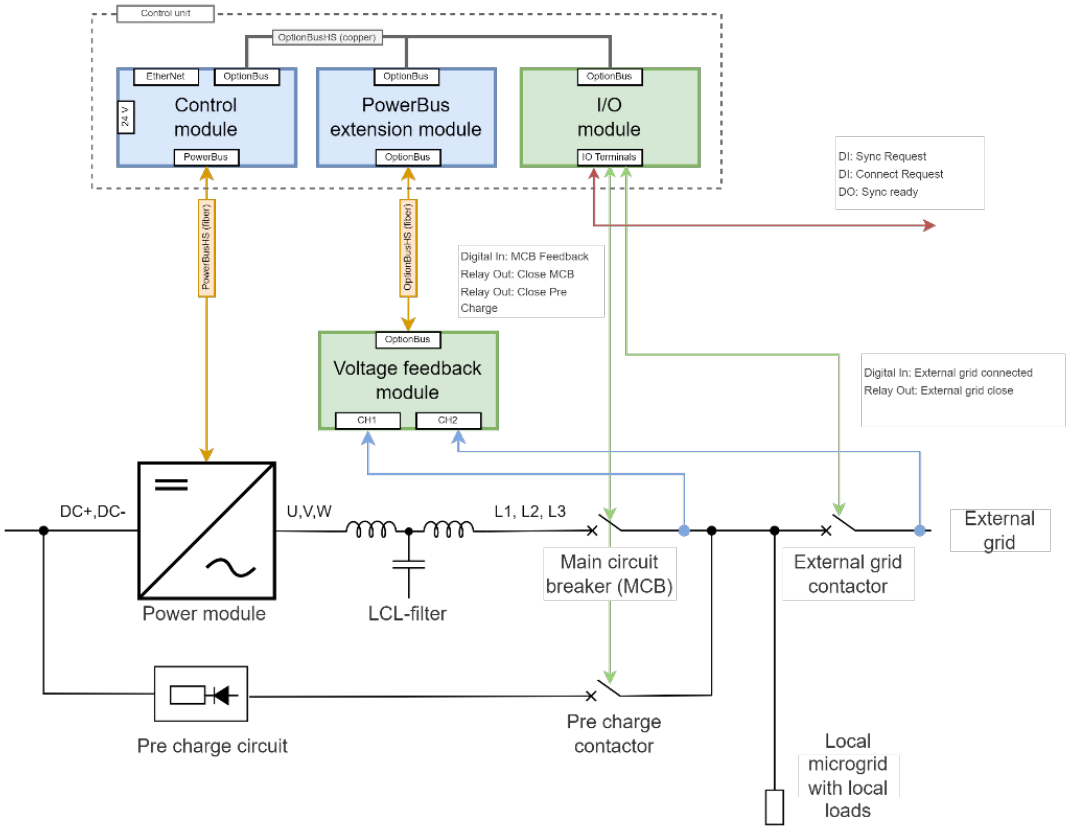


Figure 31: External grid synchronization

The external grid synchronization request can be initiated by a digital input ***Ext. Grid Synchronize Input (6595)***. Based on the request, the grid converter tries to synchronize its output voltage, frequency, and phase angle to the respective measurement channel.
The measurement channel is selected using ***Ext. Grid Voltage Feedback Source (6605)***. It has the following 3 selections:

0: Off
1: X52 (CH1)
2:X53 (CH2)

Grid Converter can only successfully synchronize to a grid when the following conditions are met:

- ***Grid Undervoltage Instant Fault Limit (No. 2843)*** < X52 or X53 Voltage (parameter ***No. 4086*** or ***No. 4089*** based on the selection from ***Grid Voltage Feedback Source No. 6539)*** < ***Grid Overvoltage Instant Fault Limit (No. 2842)***
- ***Low Freq. Instant Fault Limit (No. 2840)*** < X52 or X53 Frequency (parameter ***No. 4087*** or ***No. 4090*** based on the selection from ***Grid Voltage Feedback Source (No. 6539)***) < ***High Freq. Instant Fault Limit (No. 2840)***

In the previous illustration, X53 of the OC7V0 is connected to the external grid. Therefore, X53 is selected for ***Ext. Grid Voltage Feedback Source (No. 6605)***. Once the synchronization is ready, the ***Ext. Grid Status Word (No. 6594)*** shows all the bits high. A digital output can also be configured to indicate the external grid synchronization ready status using ***Ext. Grid Synchronized Output (No. 6599)***.
The feature also includes an interlock ***Ext. Grid Connect Enable Input (No. 6598)*** to allow a connection to the external grid. This interlock must be activated to enable the connection. The default value of the interlock is set to TRUE, but it can also be configured as a digital input.

After the synchronization is ready and the interlock to connect has been activated, closing the external grid breaker can be requested using the digital input ***Ext. Grid Connect Input (6596)***. All the digital inputs can be activated together to start the synchronization and connect to the external grid as soon as all the conditions are met.
The digital output to close the external grid breaker can be configured using ***Ext. Grid Connect Output (No. 6600)***. The external grid breaker feedback can also be configured using the digital input ***Ext. Grid Connect Feedback Input (No. 6597)***. If the feedback input is not used, then the feedback is simulated by the grid converter based on the digital output to close the external grid breaker. The feedback delay can also be configured using ***Ext. Grid Connected Feedback Delay (No. 6604)***. When the grid converter receives the feedback, the internal synchronization request is removed since the grid converter goes to the grid-connected configuration. Based on the feedback, the converter response can be configured using ***Ext. Grid Connected Response (No. 6602)***. The response can be configured to be one of the following:

0: No Operation Mode Change

Setting the ***Ext.Grid Connected Response (No. 6602***) to No Operation Mode Change keeps the converter's operating mode the same as selected with parameter ***Operation Mode (No. 161)*** after the grid converter is connected to the external grid.

1: Change to Ext. Grid Control Mode (Default)

The default setting for the ***Ext. Grid Connected Response (No. 6602)*** parameter is "Change to Ext. Grid Control Mode." This response allows the converter to automatically switch its operating mode once it is connected to the external grid. Any operating mode can be selected through the ***Ext. Grid Control Mode (No. 6603)*** parameter. For example, the converter could autonomously switch from droop mode to DC-link Voltage (AFE) mode after the external grid is connected. The default setting for ***Ext. Grid Control Mode (No. 6603)*** is "DC-link Voltage (AFE) mode".

2: Stop Converter after External Grid is Connected

When the "Stop Converter after External Grid is Connected" response is set for ***Ext. Grid Connected Response (No. 6602)*** parameter, the converter stops the modulation 100 milliseconds after the external grid is successfully connected. It is possible to start the converter again by issuing a new run command. A use case for this response can be a vessel that would shift its load to the onshore grid after docking.

The following flowchart explains the sequence of the functionality:

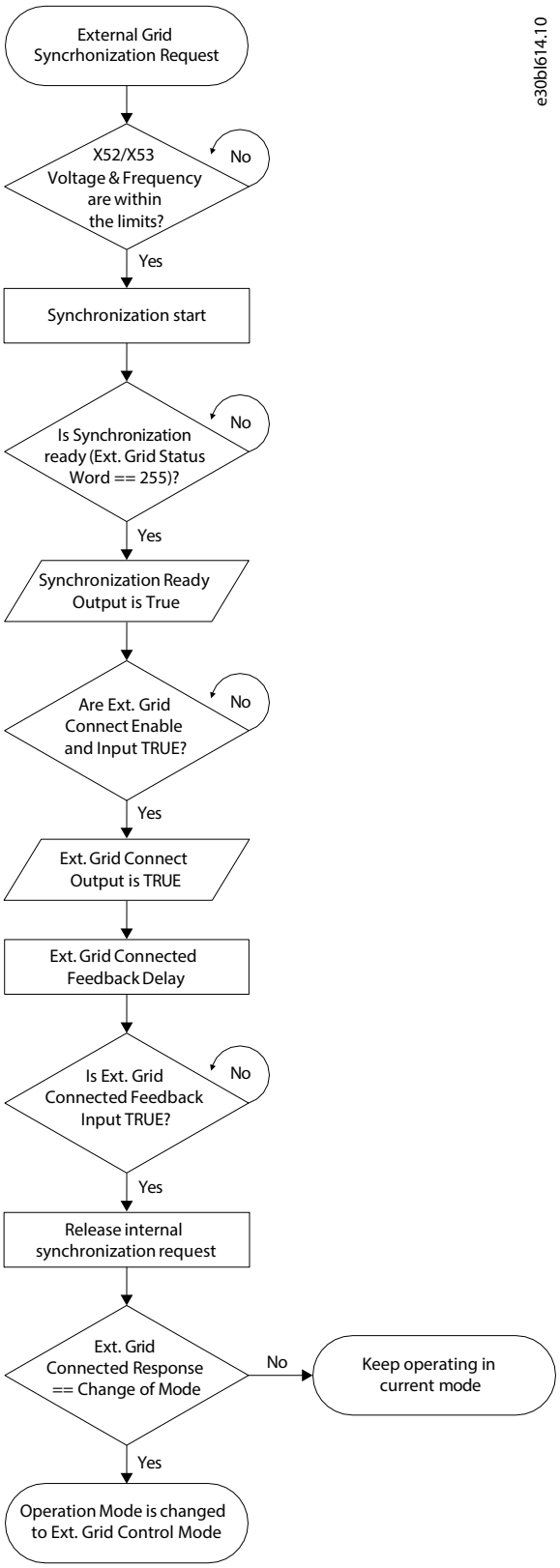


Figure 32: Grid Synchronization Flowchart

3.16 Start and Stop

3.16.1 Start and Stop Sequences

The power-up sequence of the grid converter system can be configured. The start sequence and parameters ***Pre-Charge Ready Level (No. 6566)*** and ***MCB Closing Mode (No. 6559)*** affect the startup behavior. The Main Circuit Breaker closing mode can be configured to be 1 of the following:

- DC-Link pre-charging ready (this is the default selection)
- Start command
- DC-Link pre-charging ready or start command
- LCL filter energized

The DC link pre-charging can be started based on a start command or a dedicated digital input. The start and stop sequence, charging, and the main circuit breaker can be controlled via the fieldbus or the I/O interface.

3.16.2 Starting when DC-Link Pre-charging Ready is the MCB Closing Mode

In a typical startup sequence, the unit is responsible for controlling the DC-link pre-charging and connecting to the AC grid using the Main Circuit Breaker (MCB) with default settings. The following start and stop sequence illustrations provide an overview on the process conditions and stages.

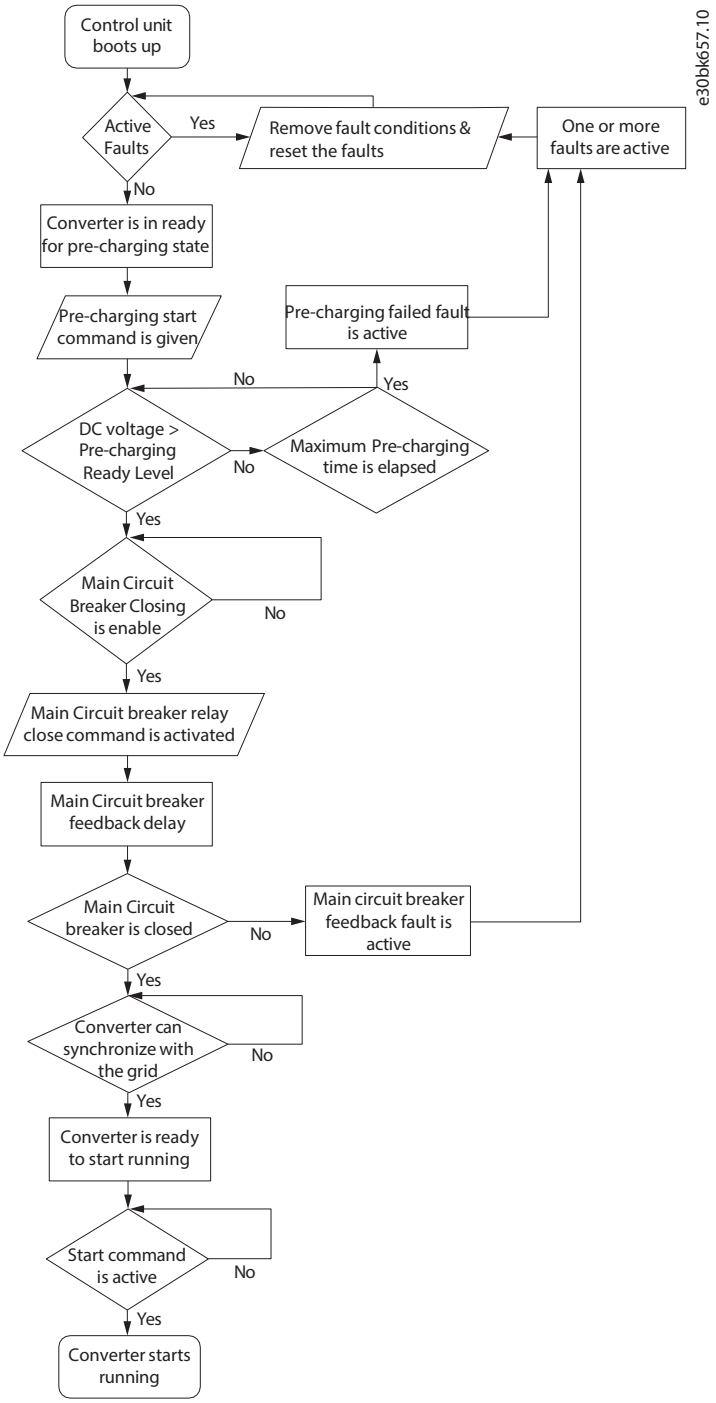


Figure 33: Start Sequence

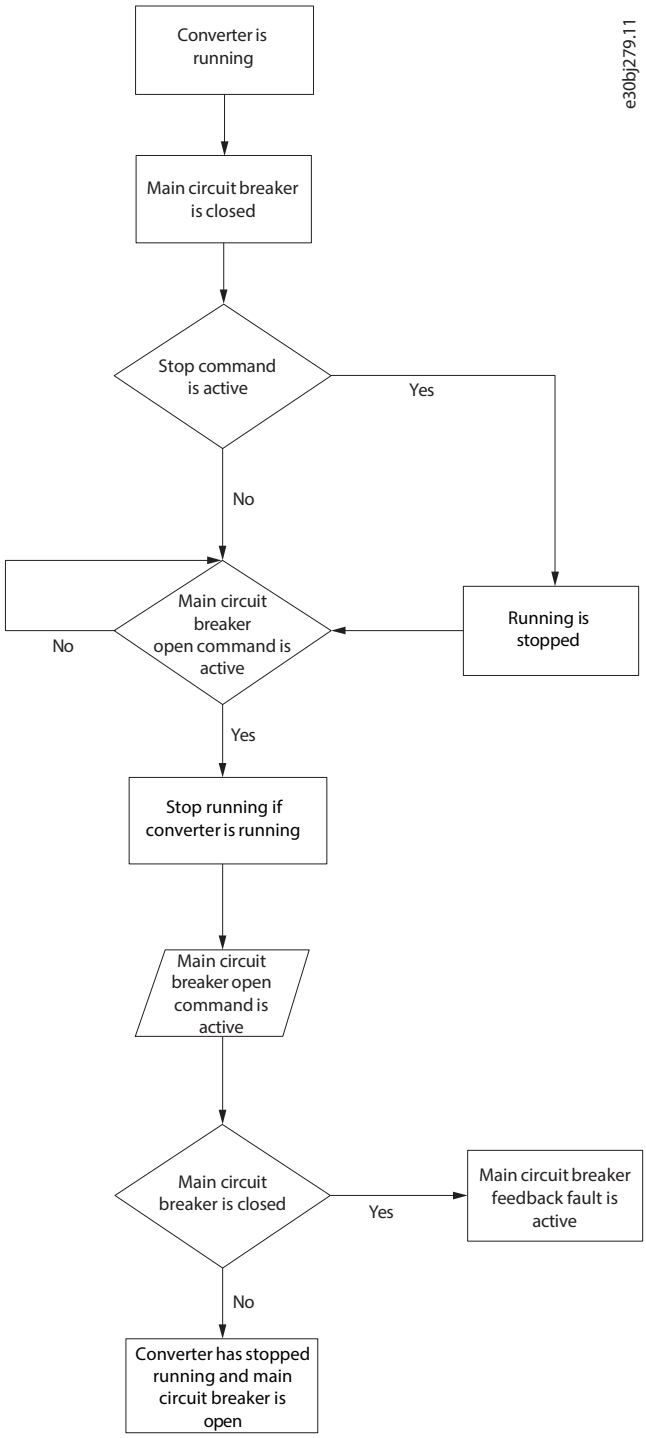


Figure 34: Stop Sequence

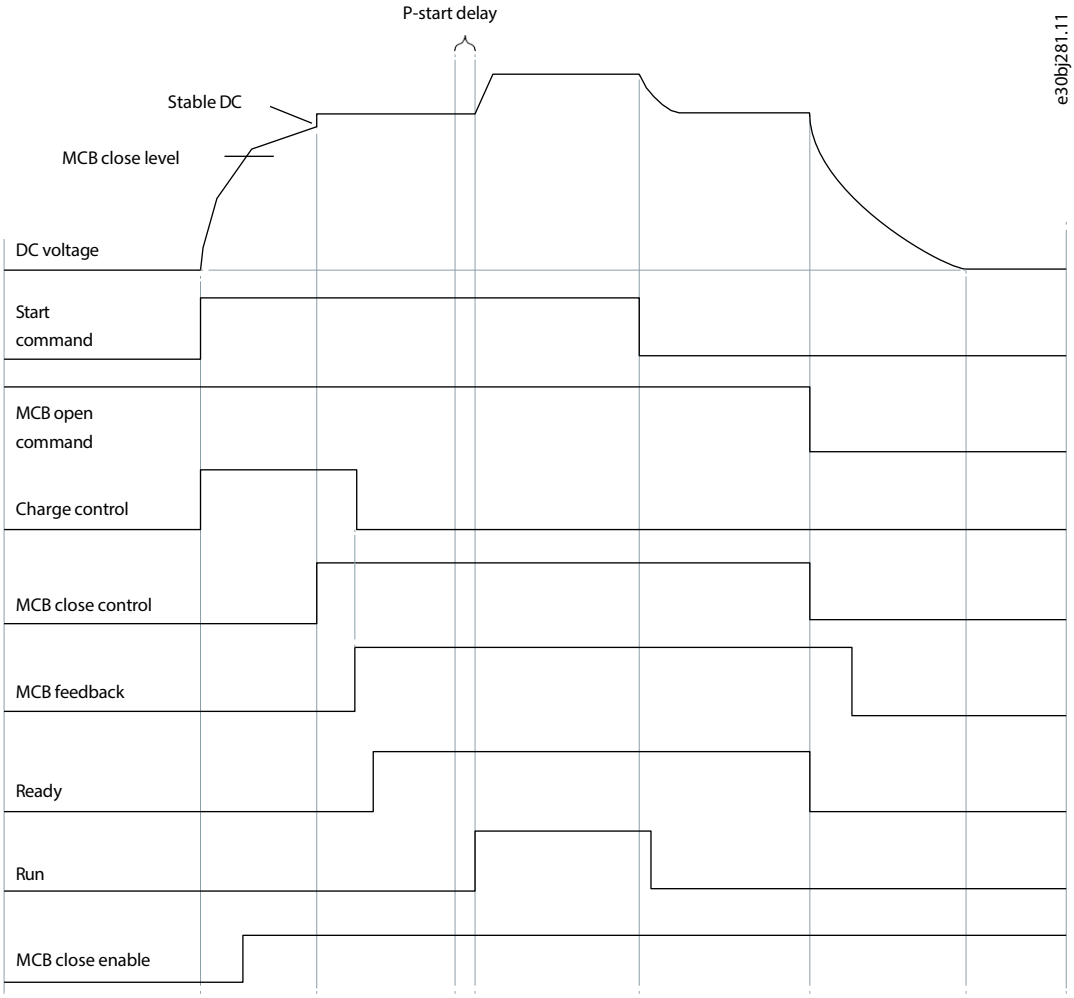


Figure 35: Pre-charging and Main Circuit Breaker (MCB) Operation

3.16.3 Starting when Filter Energization Ready is the MCB Closing Mode

In this mode, the DC link is charged first, and the converter is allowed to run to pre-energize and synchronize the voltage of the LCL filter before the command to close the main circuit breaker is issued. An external voltage measurement board is required for this mode. The voltage measurement board must be connected behind the main circuit breaker. A typical startup sequence, when the unit is responsible for controlling the DC-link pre-charging and connecting to the AC grid after the filter is energized, is illustrated in Figure 36.

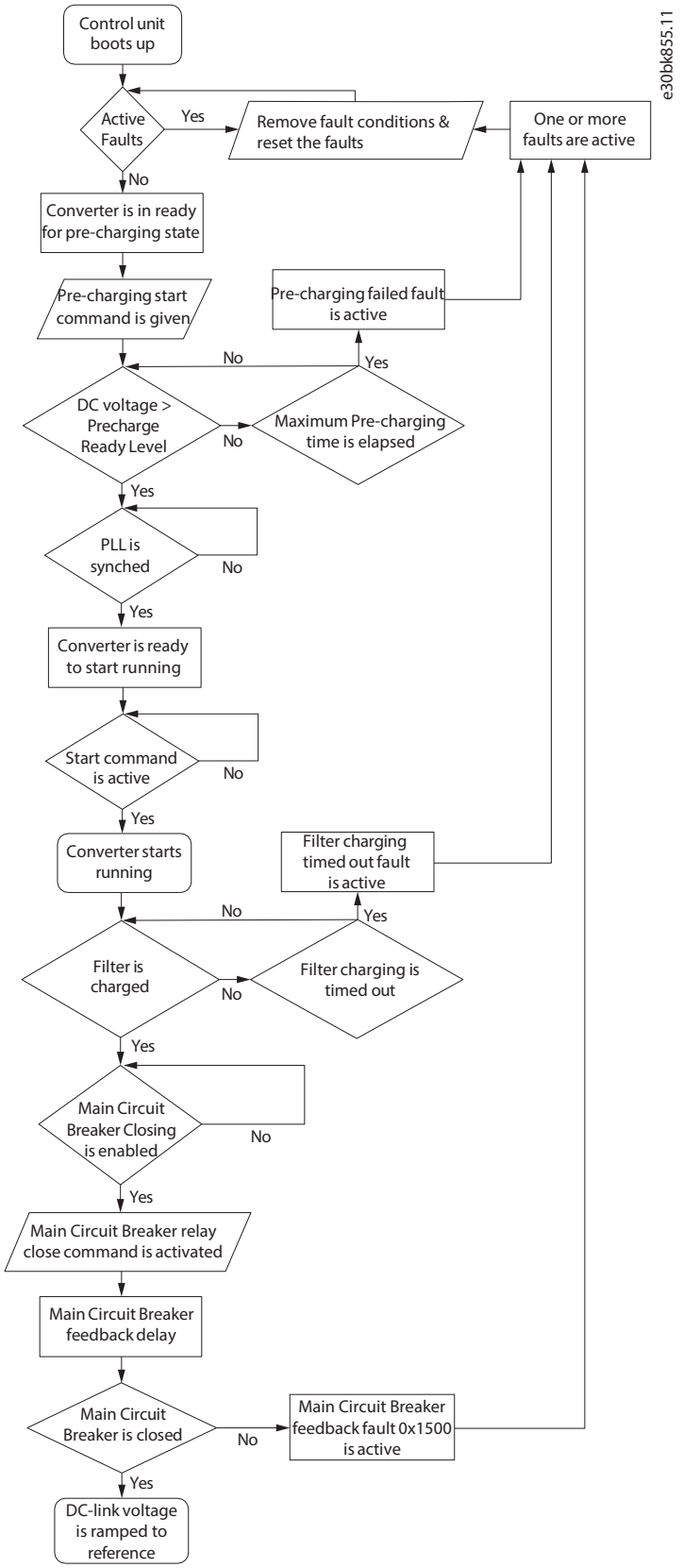


Figure 36: Start Sequence when Filter Energization Ready is the MCB Closing Mode

This mode reduces the inrush current from the grid when the main circuit breaker is closed. Before the main circuit breaker is closed, the filter voltage is ramped up to the measured grid voltage during the time defined by parameter ***Filter Voltage Ramp Time (No. 5161)***. If filter energization takes more than the time defined by parameter ***Max. Filter Energization Time (No. 5162)***, filter energization fails and causes a fault. DC-link pre-charging has a minimum pre-charging time, which can be set with parameter ***Min. Pre-Charge Time (No. 6565)***. The minimum pre-charging time must be configured according to the dimensioning of the pre-charging circuit.

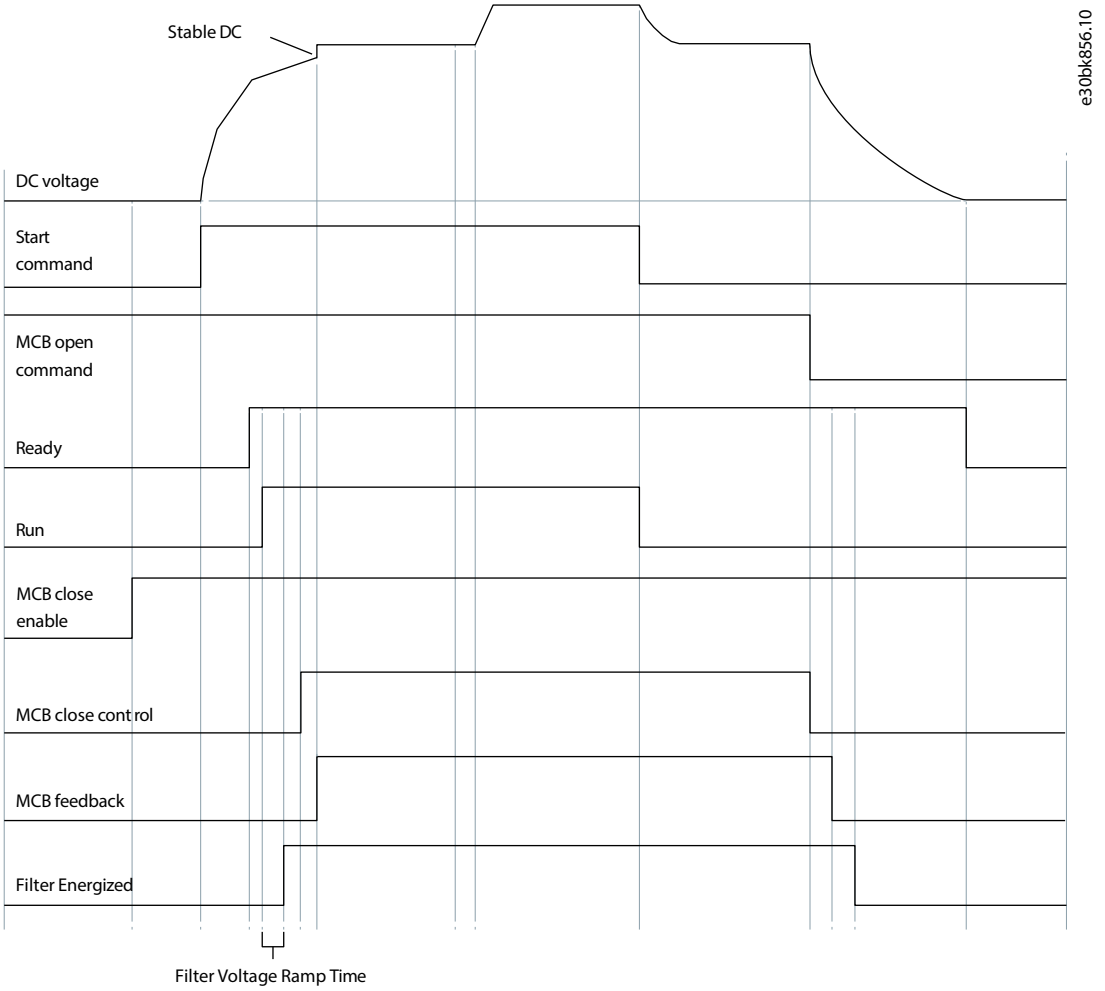


Figure 37: Main Circuit Breaker (MCB) Operation with Filter Energization

4 Control Places

4.1 Overview of Control Places

The converter can be controlled from four different control places.

If there are simultaneous control requests from PC control and local control (Control Panel), and for control place forcing, the priority order of the control places is as follows:

1. PC Control (MyDrive Insight)
2. Local Control (Control Panel)
3. I/O Control
4. Fieldbus Control

4.2 Control Place Selection

Figure 38 shows the control place selection chain diagram. The default method for selecting the control place is by using the parameter ***Control Place Selection (No. 114)***. It can be used to select the active control place between local (Control Panel), fieldbus, and I/O.

The second option for control place selection is to use control place forcing signals. This method overrides the selection made with the parameter ***Control Place Selection (No. 114)***, and can be used to swap between different control places via external push buttons or switches, for example. The forcing signals for fieldbus and I/O can be mapped to digital inputs or the fieldbus, and the local control forcing is activated with the *REM/LOC* button of the control panel.

The priority order for control place forcing is configured with parameter ***Control Place Forcing Priority (No. 4732)***. If two or more control places are forced active simultaneously, the priority order determines the final control place selection. For example, if fieldbus is selected for the highest priority (Index (0) in Figure 38) and I/O for the next highest priority (Index (1) in Figure 38), and both control places are forced active simultaneously, fieldbus is selected as the active control place because it has been configured for higher priority than I/O. After fieldbus forcing is removed, the control place will fall to I/O because it has higher priority than the parameter selection.

The only control place which can take over control from any other control place regardless of forcing inputs is PC control (MyDrive Insight).

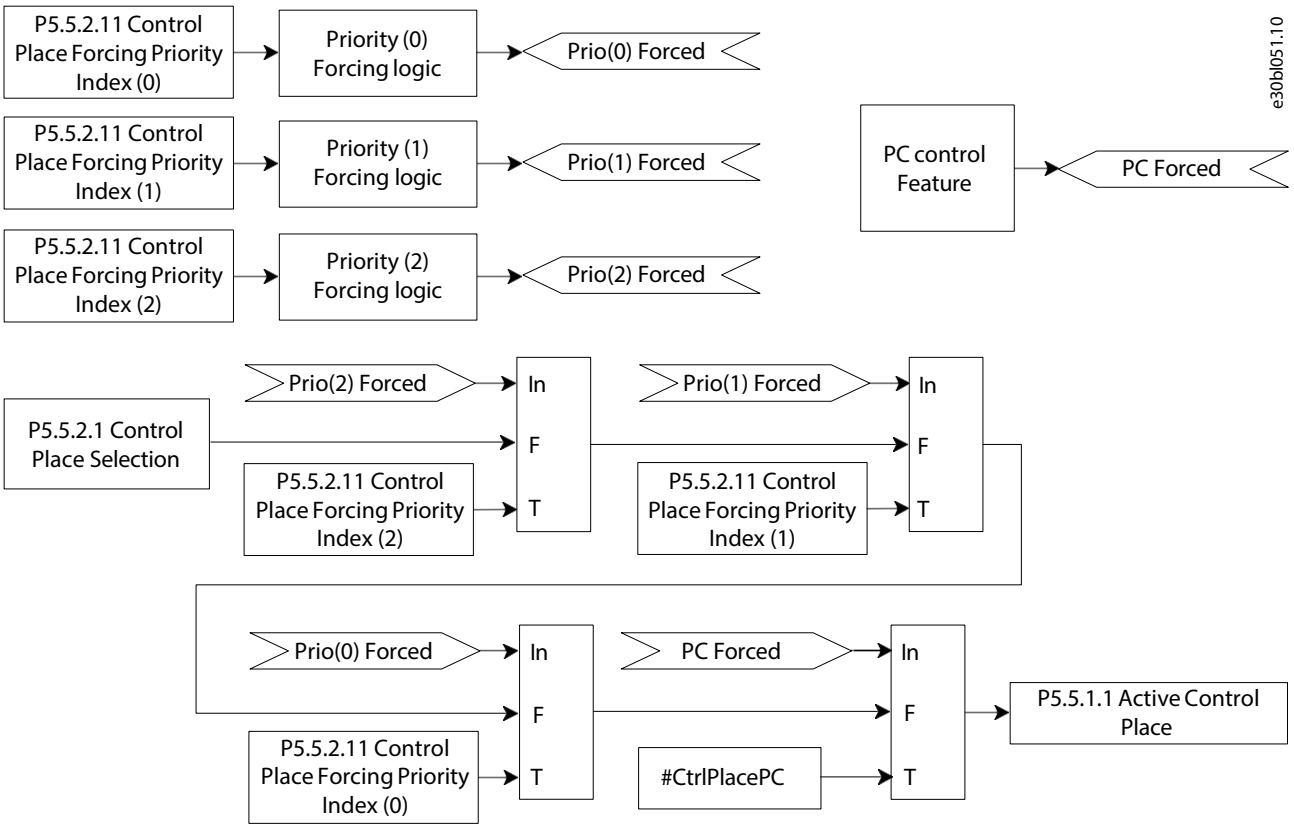


Figure 38: Control Place Priority Chain

Each control place defines the source for start, stop, and warning and fault reset commands. The latter depends on parameter ***Control Place Independent Reset (No.109)***.

The reference which must be followed is configured by reference selection parameters, independently from the selected control place. The following table shows the reference and limit controller source selections that are available:

Table 12: Reference and Limit Controller Source Selection

References and limit controllers/Source	Parameters	Fieldbus	Analog input	Fixed preset
AC Voltage		X		X (100%)
Frequency		X		X (100%)
Active Current Reference	X	X	X	
Active Power Reference	X	X	X	
Reactive Current Reference	X	X		
Reactive Power Reference	X	X		
Neg. Active Current Limit	X	X	X	
Pos. Active Current Limit	X	X	X	
Neg. Active Power Limit	X	X	X	
Pos. Active Power Limit	X	X	X	
DC-Link Voltage Reference	X	X		

Table 12: Reference and Limit Controller Source Selection *(continued)*

References and limit controllers/Source	Parameters	Fieldbus	Analog input	Fixed preset
Overvoltage Control	X	X		
Undervoltage Control	X	X		
DC-Link Current Reference	X	X	X	
DC-Link Power Reference	X	X	X	

4.3 I/O Control

In I/O Control, the grid converter can be started or stopped with the parameter ***I/O Start Input (No. 200)***. A stop command can also be issued with the parameter ***I/O Stop Input (No. 201)***. Faults and warnings can be reset while in I/O control with the parameter ***I/O Reset Input (No. 203)***.

The start and stop mode of the converter can be configured with the parameter ***I/O Start Mode (No. 213)***. The following start and stop modes can be selected:

Table 13: I/O Control Start and Stop Modes

Selection number	Name	Description
0	State sensitive	• A high state of the signal is the start request. • The converter stops if the start signal is removed. • If the start signal is high when a fault is cleared, or an *I/O Stop Input* signal is removed, the converter starts running immediately. • An *I/O Stop Input* or *Switch On Enable Input* signal prevents the converter from starting.
1	Rising edge	• A combination of a rising edge and high state of the signal is the start request. • The converter stops if the start signal is removed. • If the start signal is high when a fault is cleared, or an *I/O Stop Input* signal is removed, the converter does not start running. • An *I/O Stop Input* or *Switch On Enable Input* signal prevents the converter from starting.
2	Pulse	• A rising edge of the signal is the start request. • A rising edge of an *I/O Stop Input* signal stops the converter. • If the start signal is high when a fault is cleared, or an *I/O Stop Input* signal is removed, the converter does not start running. • An *I/O Stop Input* or *Switch On Enable Input* signal prevents the converter from starting.

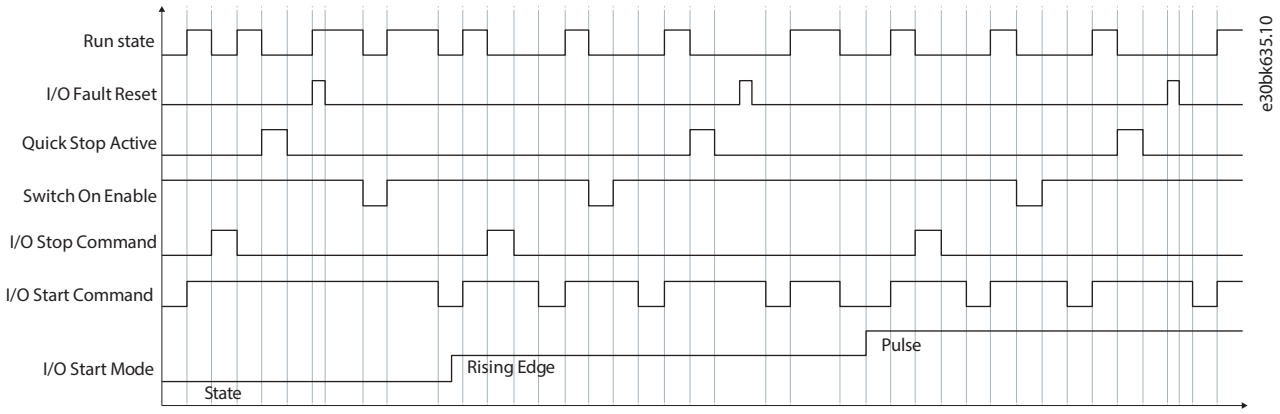


Figure 39: I/O Control

4.4 Fieldbus Control

The fieldbus control place makes it possible to send control commands based on the fieldbus profile. The fieldbus status word is always available and updated irrespective of the active control place. The fieldbus start and stop mode is configured with the parameter ***Fieldbus Start Mode (No. 5114)***. Start and stop modes are similar to I/O control, except that in fieldbus control only State and Rising Edge start modes are supported.

Table 14: Fieldbus Control Start and Stop Modes

Selection number	Name	Description
0	State sensitive	• The high state of bit 3 (the Start and Stop bit) is the start request. • When bit 3 is false, the converter stops. • If the start bit is high when a fault is cleared, the converter starts running immediately. • Switch on enable (bit 0) and MCB close enable (bit 1) block the start.
1	Rising edge	• The combination of a rising edge and high state of bit 3 (the Start and Stop bit) it the start request. • When bit 3 is false the converter stops. • The converter does not start running in case bit 3 is true when a fault is cleared. • Switch on enable (bit 0) and MCB close enable (bit 1) block the start.

iC7-Hybrid provides a flexible fieldbus interface, which can be mapped according to customer needs.

The following illustrations are only applicable when control is through fieldbus, when bit 10 is true, and fieldbus control place is the active control place. The gray boxes represent the control word bits which are required to transition between different states. The white boxes represent different states of the fieldbus profile, indicating the value of status word bits, which must be in the state shown.

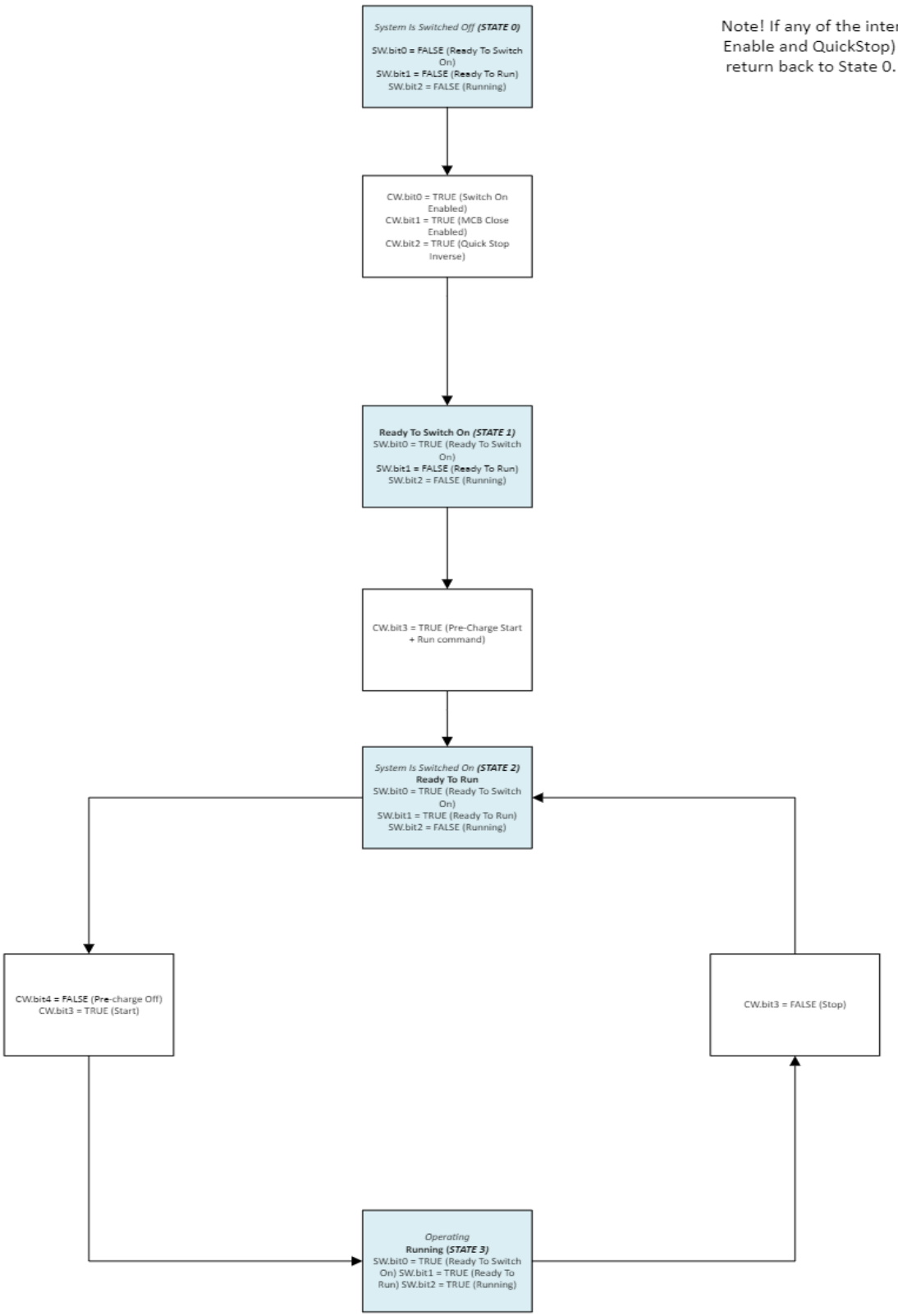


Figure 40: The Standard Startup Sequence

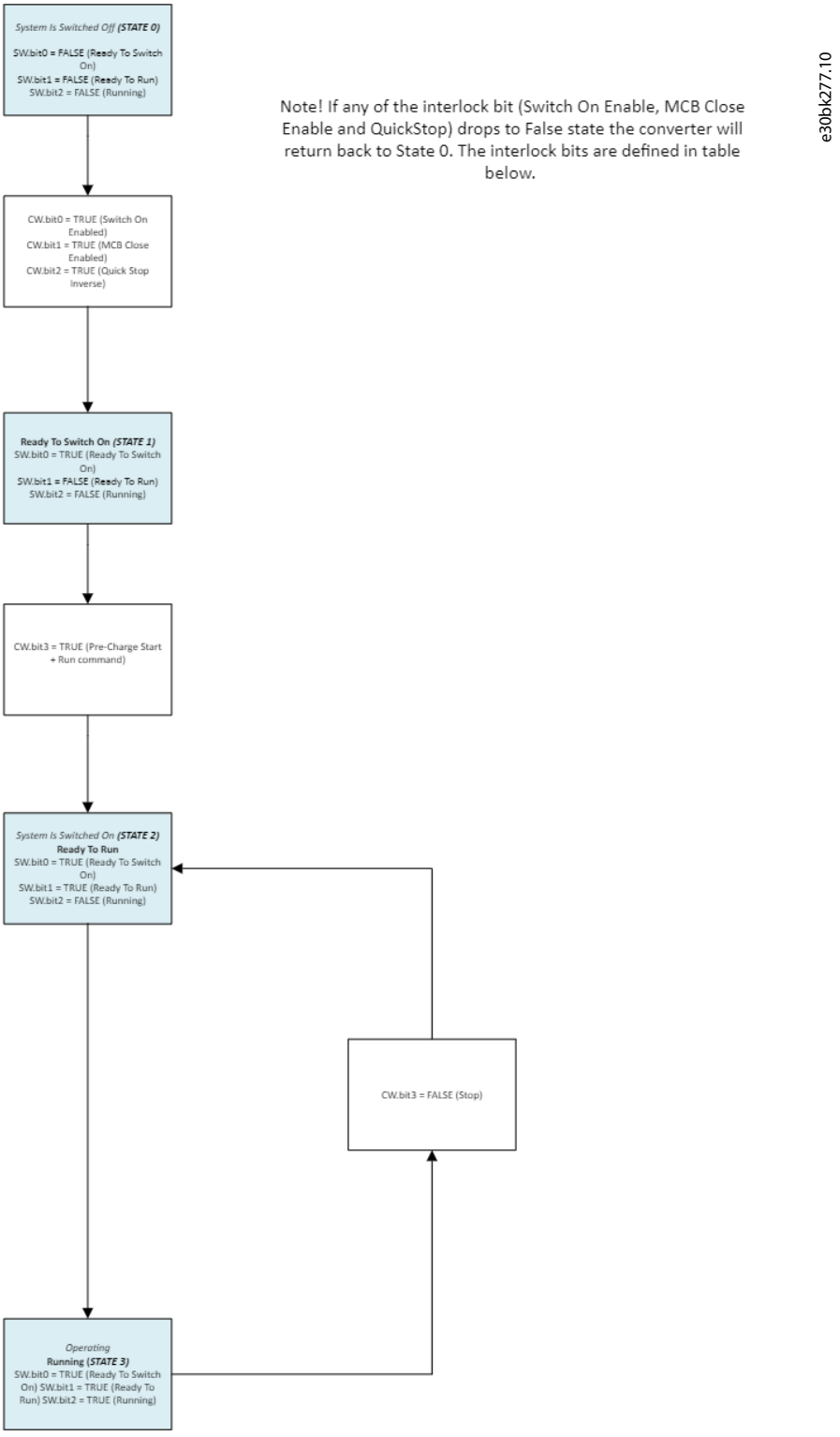


Figure 41: The Start Command activates the Pre-charging Sequence and Starts the Converter Running

Table 15: States and Descriptions

State	Description
System is switched off	Prohibits the converter from starting.
Ready to switch on	The converter is ready to start charging, with no active faults and no active conditions to inhibit switching on.
System is switched on	The converter is pre-charged.
Operating	The converter is running.

4.4.1 Fieldbus Control Word and Bit Descriptions

Table 16: Fieldbus Control Word

Bit	Name	Description	Further information
0	Switch On Enabled	0: Pre-charging(*), closing the main circuit breaker(*), and running are prevented or interrupted. If the main circuit breaker is closed, it is opened(*). 1: Pre-charging(*), closing the main circuit breaker(*), and running are not prevented or interrupted. (*) If controlled by the grid converter unit.	This bit behaves as start and run interlock. When this bit is set to high (True), only then control word bit 3 can enable operation of the unit. Whenever this bit falls to low (False) state while running, the unit is forced to stop.
1	MCB Close Enabled	0: Closing the main circuit breaker is prevented(*) or the main circuit breaker is opened(*), and running is prevented or interrupted. 1: Closing the main circuit breaker is not prevented(*). (*) If controlled by the grid converter unit.	This bit behaves as interlock that allows MCB to close when charging is completed. If the bit is removed anytime during operation, then unit is forced to stop.
2	Quick Stop Inverse	0: Activate Quick Stop. 1: Do not activate Quick Stop.	This bit is used to request a quick stop to be executed. When the bit is set to false during operation, the unit stops modulation, and depending on the configuration an exception is issued.
3	Start	0: Stop the unit if it is running or stop the startup sequence if it is not completed. 1: Initiate the startup sequence (DC-link pre-charging(*), closing the main circuit breaker(*), and start running), or keep the unit running. (*) If applicable.	Depending on Fieldbus Start Mode (No.5114) a rising edge or state high is required for DC-link pre-charging to start thus moving from State Block 2 to State Block 3 (Figure 40) or from State Block 1 to State Block 2 (Figure 41).
4	Pre-charge	0: Stop the DC-link pre-charging, if ongoing. 1: Start or continue the DC-link pre-charging.	This bit is only used when the DC-link pre-charging is controlled by the application.
5	--	Reserved	
6	--	Reserved	

7	Event Reset	0: No action. 1: Reset active events.	This bit is used to acknowledge faults in the converter. A rising edge (a transition from false to true) on this bit issues an event reset request.
8	--	Reserved	
9	--	Reserved	
10	Data Valid	0: Ignore the current incoming process data values, instead use the last processed value when the Data Valid bit was true. 1: Use the current incoming process data values.	For Modbus protocol, this bit currently applies to control word only. For bit 11 ('Watchdog'), the current control word value is used regardless. The default control word value is 0x5. The default value is used as the initial value when the Data Valid bit is false, and whenever the fieldbus watchdog supervision fault is active (event no. 5161 active, when configured as a fault).
11	Watchdog	Incoming watchdog bit from customer.	This is the input bit used for the fieldbus watchdog.
12	Vendor Specific Bit 1	0: Deactivate vendor specific function using digital input. 1: Activate vendor specific function using digital input.	
13	Vendor Specific Bit 2	0: Deactivate vendor specific function using digital input. 1: Activate vendor specific function using digital input.	
14	Vendor Specific Bit 3	0: Deactivate vendor specific function using digital input. 1: Activate vendor specific function using digital input.	
15	Vendor Specific Bit 4	0: Deactivate vendor specific function using digital input. 1: Activate vendor specific function using digital input.	

When the control place is not fieldbus, all bits other than ***Data Valid*** and ***Watchdog*** are ignored. However, depending on parameter ***Control Place Independent Reset (No. 109)***, ***Exception Reset*** can also be functional.

4.4.2 Fieldbus Status Word and Bit Descriptions

Table 17: Fieldbus Status Word

Bit	Name	Description	Further information
0	Ready to Switch On	0: Not ready to switch on 1: Ready to switch on	This bit is true if all following conditions are satisfied: • Switch on enable is present • Quick stop is not requested • No faults are active
1	Ready to Run	0: Converter is not ready to start (Check the ***Grid Control Ready Status Word*** and ***Application Ready Status Word***) 1: Converter is ready to start modulating	All the bits of ***Grid Control Ready Status*** as well as ***Application Ready Status*** must be high to get Ready to Run to be true.
2	Running	0: Converter is not modulating 1: Converter is modulating	
3	Fault	0: No faults are active 1: One or more faults are active	
4	--	Reserved	
5	Quick Stop Inverse	0: Quick stop active 1: Quick stop not active	
6	--	Reserved	
7	Warning	0: No warnings active 1: One or more warnings are active	
8	--	Reserved	
9	Control by PLC	0: The active control place is not fieldbus 1: The active control place is fieldbus	
10	--	Reserved	
11	Run Enabled	0: Run enabled from the dedicated input signal is missing 1: Run enabled from the dedicated input signal is present	
12	--	Reserved	
13	--	Reserved	
14	--	Reserved	
15	Watchdog	Outgoing fieldbus watchdog bit	

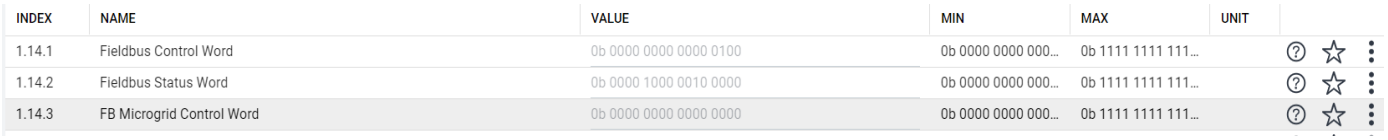
4.4.3 Microgrid Control Word and Bit Descriptions

The microgrid control word can be used to force certain functions through the fieldbus. The following table describes the functions which can be forced:

Table 18: Microgrid Control Word

Bit	Name	Description
0	Force DC Voltage Control Mode	0: Do not force the DC Voltage Control (AFE) operating mode. 1: Force the DC Voltage Control (AFE) operating mode.
1	Force Island Control Mode	0: Do not force the Island operating mode. 1: Force the Island operating mode.
2	Force Droop Control Mode	0: Do not force the Droop Control operating mode. 1: Force the Droop Control operating mode.
3	Force Droop Control with Base Load Mode	0: Do not force the Droop Control with Base Load operating mode. 1: Force the Droop Control with Base Load operating mode.
4	Force PQ Control Mode	0: Do not force the PQ Control operating mode. 1: Force the PQ Control operating mode.
5	Force DC-link Current/Power Control Mode	0: Do not force the DC-link Current/Power operating mode. 1: Force the DC-link Current/Power operating mode.
6	Force AC Current/Power Control Mode	0: Do not force the AC Current/Power Control operating mode. 1: Force the AC Current/Power Control operating mode.
7	Increase Frequency Reference	0: Do not increase the grid frequency reference. 1: Increase the grid frequency reference.
8	Decrease Frequency Reference	0: Do not decrease the grid frequency reference. 1: Decrease the grid frequency reference.
9	Frequency Reference Reset	0: Do not reset the grid frequency reference. 1: Reset the grid frequency reference.
10	Increase Voltage Reference	0: Do not increase the grid voltage reference. 1: Increase the grid voltage reference.
11	Decrease Voltage Reference	0: Do not decrease the grid voltage reference. 1: Decrease the grid voltage reference.
12	Voltage Reference Reset	0: Do not reset the grid voltage reference. 1: Reset the grid voltage reference.
13	Frequency Reference Reset Value Selection	0: Reset the grid frequency reference to grid nominal value. 1: Reset the grid frequency reference to grid actual value.
14	Voltage Reference Reset Value Selection	0: Reset the grid voltage reference to grid nominal value. 1: Reset the grid voltage reference to grid actual value.
15	Reserved	

This status of Microgrid Control Word can be checked through the monitoring word No. 1500 as highlighted below,



INDEX	NAME	VALUE	MIN	MAX	UNIT
1.14.1	Fieldbus Control Word	0b 0000 0000 0000 0100	0b 0000 0000 000...	0b 1111 1111 111...	
1.14.2	Fieldbus Status Word	0b 0000 1000 0010 0000	0b 0000 0000 000...	0b 1111 1111 111...	
1.14.3	FB Microgrid Control Word	0b 0000 0000 0000 0000	0b 0000 0000 000...	0b 1111 1111 111...	

The priority order of the control modes is listed in the following table, with the lowest number being the lowest priority:

Table 19: Control mode priority

Priority	Control mode
7	AC Current/Power Control mode
6	DC-link Current/Power Control mode
5	DC-link Voltage Control mode
4	Island mode
3	Droop Control mode
2	Droop Control with Base Load mode
1	PQ Control mode

4.4.4 Custom Status Word and Bit Descriptions

The Custom Status Word is a fully customizable status word.

The bits of the status word can be configured to any bit from the following status words:
- Grid Control Mode Selection Status Word
- Application Specific Status Word 1
- Application Specific Status Word 2
- Limit Control Status Word

The default configuration is shown in the following table:

Table 20: Custom Status Word

Bit	Name	Description
0	Bit 0 from Grid Control Mode Selection Status Word	Shows whether converter is operating in Island mode.
1	Bit 1 from Grid Control Mode Selection Status Word	Shows whether converter is operating in Droop mode.
2	Bit 2 from Grid Control Mode Selection Status Word	Shows whether converter is operating in Droop with Base Load mode.
3	Bit 3 from Grid Control Mode Selection Status Word	Shows whether converter is operating in PQ mode.
4	Bit 4 from Grid Control Mode Selection Status Word	Shows whether converter is operating in DC Voltage Control (AFE) mode.
5	Bit 1 from Application Specific Status Word 2	Shows the status of a toggled warning.
6	Bit 2 from Application Specific Status Word 2	Shows the status of a toggled fault.
7	Bit 10 from Application Specific Status Word 2	Shows whether pre-charging is ready.
8–15	Not configured	

4.5 Local Control

Local control can only be requested from the control panel. The request is always rising edge based, the local control place is requested and released by pressing the *Rem/Local* button. Only the start and stop commands are possible using the respective buttons in the control panel. However, the *Stop* button stops the converter irrespective to the active control place. Holding the *Stop*button for 3 seconds issues a *Switch Off* command, which opens the main circuit breaker (if the breaker is controlled by the application).

It is also possible to reset a fault from the active fault screen.

4.6 PC Control

PC control can be requested using the PC tool, MyDrive Insight. The converter can be started and stopped using MyDrive Insight. The *Coast Stop* button issues a Switch Off command, which opens the main circuit breaker (if the breaker is controlled by the application). There is also a fault reset button. No reference can be set using MyDrive Insight, and even if the reference field of MyDrive Insight allows the setting of a reference, it is not taken into use.

4.7 Continue Operation

Normally, if the grid converter is running when the control place is changed, it stops. If the continue operation function is enabled for the new control place, the unit continues running when the control place is switched as long as a stop is not requested through the new control place.

Continue operation can be enabled with parameters ***Continue Operation in Local Control (No.108)***, ***Continue Operation in Fieldbus control (No. 5112)***, and ***Continue Operation in I/O Control (No. 5111)***.

If ***State High Start*** or ***Rising Edge Start*** is the selected start mode in the new control place, a low start signal or control word bit also generates a stop request. Therefore the unit does not continue running.

5 Configuration Examples

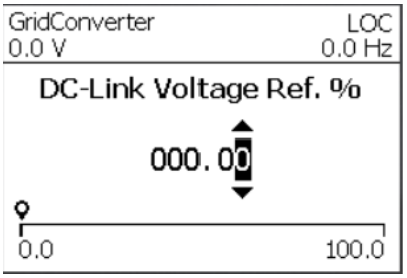
5.1 Configuring Basic Converter Settings

5.1.1 Setting Up the Converter Using the Control Panel

Prerequisites:

1. Ensure that the drive is mounted safely as described in the iC7 Series Liquid-Cooled System Modules Operating Guide. The procedure covers the basic settings for Grid Converter using the control panel.
2. Power up the converter.
3. To navigate to the menu structure, press *Home/Menu* button on the control panel.
4. To run the converter in local control, press *REM/LOC*.

   The HMI Reference screen is shown in the control panel.



5. Set basic Grid Converter settings to configure the nominal values.

Table 21: Basic Grid Converter Settings

Menu index	Parameter name	Recommended parameter setting	Parameter number
1.2.4	Grid Nominal Frequency	Use default, 50	6536
1.2.5	Grid Nominal Voltage	Use default, 690	6537
1.2.6	Grid Nominal Current	Use default, 416	6538

6. If there is an unexpected event such as fault or warning, press *Info* to reset the fault or warning.

The faults or warnings that have occurred are shown on the screen. To reset the events, select *Reset all*.

Figure 42: Reset All Screen

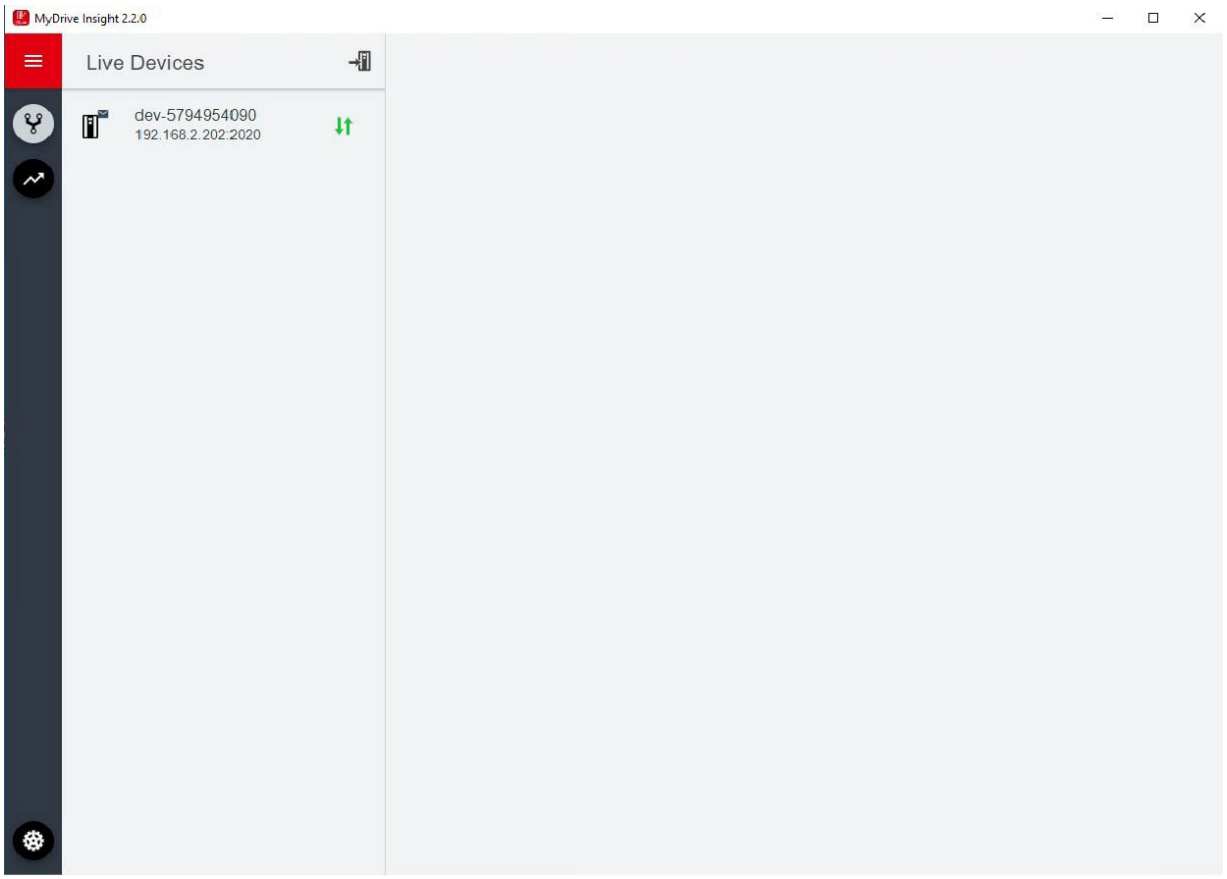
5.1.2 Setting up the converter using MyDrive Insight

Prerequisites:

1. Ensure that the drive is mounted safely as described in the iC7 Series Liquid-Cooled System Modules Operating Guide.
2. Install MyDrive Insight from MyDrive Suite app.

The procedure covers the basic settings for Grid Converter using MyDrive Insight.

1. Access MyDrive Insight and click the drive icon.



e30bi591.10

Figure 43: Active Devices

2. Go to *Setup & Service* > *Parameters*.

3. Go to *2 Parameters* > *Basic Parameters*.

4. Set basic Grid Converter settings to configure the nominal values suitable to the hardware configuration.

Table 22: Basic Grid Converter Settings

Menu index	Parameter name	Parameter number
2.1.1	Grid Nominal Frequency	6536
2.1.2	Grid Nominal Voltage	6537
2.1.3	Grid Nominal Current	6538
2.1.4	Grid Voltage Feedback Source	6539

Table 22: Basic Grid Converter Settings *(continued)*

Menu index	Parameter name	Parameter number
2.1.5	Filter Voltage Feedback Source	6541
2.1.6	Transformer Grid-Side Voltage	6123
2.1.7	Transformer Converter-Side Voltage	6124
2.1.8	Transformer Phase Shift	6125
2.1.9	Transformer Nominal Power	6126
2.1.10	Transformer Nominal Frequency	6127
2.1.11	Transformer Short-Circuit Impedance	6128
2.1.12	Transformer Nom. Load Losses	6129
2.1.13	Grid Voltage Feedback Location	6133
2.1.14	DC-Link Nominal Voltage	2834
2.1.15	Unit Voltage Class	2832
2.1.16	Overload Mode	2833
2.1.17	Current/Power Positive Direction	2947
2.1.18	Paralleling Sync. Mode	9654

5. To connect to the converter in local mode, click *Request*.
6. If there is an unexpected event such as a fault or warning, go to *Events* to view the event.
7. To reset the events, click *Reset*.

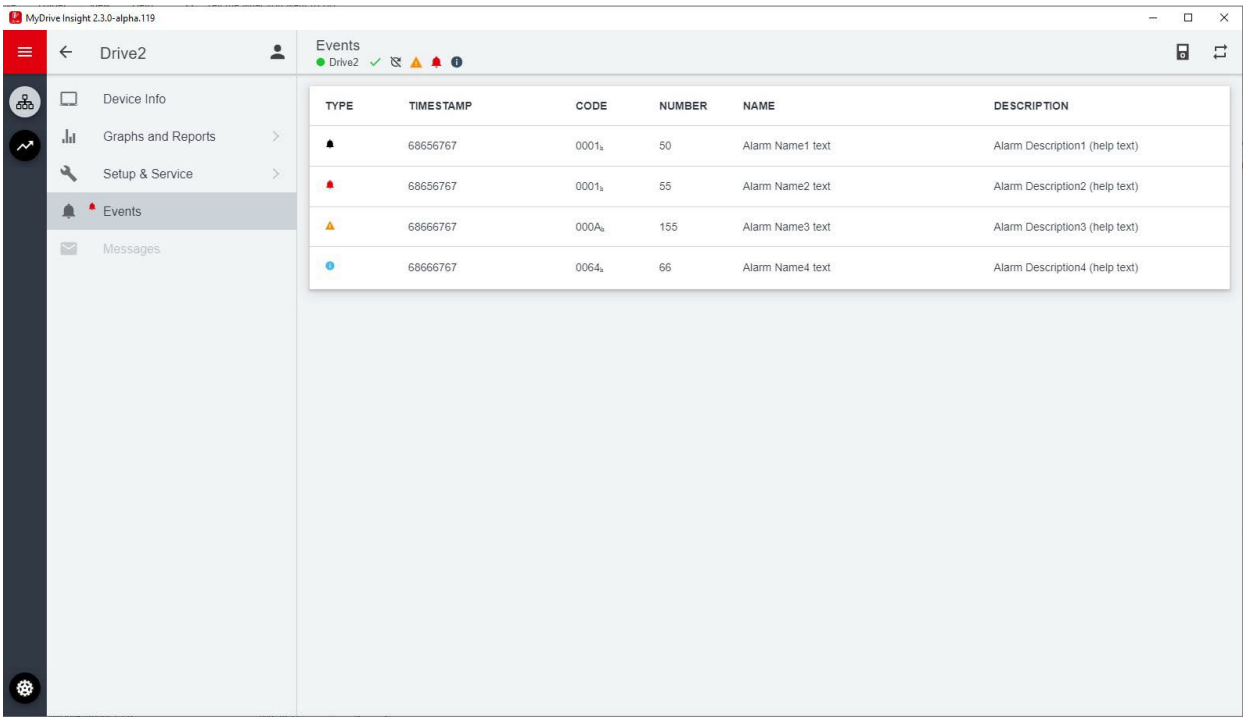


Figure 44: Events and Reset

8. To release the converter from local mode, click *Release*.

5.2 Configuring Grid Limits

This section details parameters such as percentage scaling, protections, and reference scaling in grid forming operating modes.

1. Configure the following parameters according to grid connection point during commissioning.

Parameter menu index	Parameter name	Unit	Description
2.9.13.1	Grid Overvoltage Instant Fault Limit	%	High limit for grid voltage in percentage of nominal grid voltage.
2.9.13.6	Grid Undervoltage Instant Fault Limit	%	Low limit for grid voltage in percentage of nominal grid voltage.
2.9.12.1	High Freq. Instant Fault Limit	Hz	High limit for grid frequency.
2.9.12.6	Low Freq. Instant Fault Limit	Hz	Low limit for grid frequency.

2. If the Voltage Measurement OC7V0 option is connected to the converter, take it into use to enable full grid control functionality and improved dynamic performance. The grid voltage feedback location defines whether the measurement is taken from the converter side or the load side of the transformer. Configure the following parameters:

Parameter menu index	Parameter name	Unit	Description
2.1.4	Grid Voltage Feedback Source	-	Select the channel of the Voltage Measurement OC7V0 option to which grid voltage sense is connected. The selections are: • 0: Option is not available. • 1: Grid voltage connected to channel 1 • 2: Grid voltage connected to channel 2.
2.1.13	Grid Voltage Feedback Location	-	Select the location of the grid side voltage measurement. The selections are: • 0: Converter side voltage • 1: Grid side voltage

3. The transformer parameters in the following tables are configured according to the product label values. The parameters of Table 23 concern the main transformer. A separate voltage measurement transformer is supported, and can be used to step the voltage down from the medium voltage to the voltage range of the Voltage Measurement OC7V0 option. Table 24lists the voltage measurement transformer parameters. The phase shifts indicate the converter side voltage phase difference to the load side voltage (lag=negative, lead=positive).

   Parameters ***2.1.2 Grid Nominal Voltage*** and ***2.1.3 Grid Nominal Current*** define the grid connection point nominal values, that is, the grid side of the main transformer. The grid converter adapts to the transformer ratio and phase shift to produce the requested voltage and current on the grid side of the transformer. When load side voltage feedback is used, the closed-loop control compensates for the voltage loss across the filter and transformer impedances. When the voltage feedback is from the converter side, the transformer voltage drop compensation is based on a semi-sensorless approach.

Table 23: Main Transformer

Parameter menu index	Parameter name	Unit	Description
2.1.7	Transformer Converter-Side Voltage	V	Product label value of the converter side voltage.
2.1.6	Transformer Grid-Side Voltage	V	Product label value of the grid side voltage.
2.1.8	Transformer Phase Shift	deg	Phase shift in degrees.
2.1.9	Transformer Nominal Power	kV A	Product label value of apparent power.
2.1.10	Transformer Nominal Frequency	Hz	Nominal frequency.
2.1.11	Transformer Short-Circuit Impedance	%	Product label value of short circuit impedance.
2.1.12	Transformer Nom. Load Losses	W	Product label value of load losses.

Table 24: Voltage Measurement Transformer

Parameter menu index	Parameter name	Unit	Description
9.4.3 or 9.5.3	X52 or X53 Measurement transformer grid side voltage	V	Nominal voltage of the measurement transformer load-side winding.
9.4.4 or 9.5.4	X52 or X53 Measurement transformer converter side voltage	V	Nominal voltage of the measurement transformer converter-side winding.
9.4.5 or 9.5.5	X52 or X53 Measurement transformer phase shift	deg	Phase shift of the measurement transformer, that is, the phase difference between the converter and the load voltage.

5.3 Configuring the Operation Mode and References

5.3.1 Configuring DC-Link Voltage Control

DC-link voltage (AFE) control mode is used when bi-directional power transfer and stable DC-link voltage are the main control requirements. Control can also limit regenerative power towards the grid, for example in ship grids when power generation is not permitted. For paralleling consider droop. Set limits if necessary.

For more information on paralleling, see 3.9 Paralleling Grid Converters.

1. Configure the following parameters to set up DC-link voltage control.

Parameter menu index	Parameter name	Unit	Description
2.2.1.1	Operation Mode	-	Set to 4, DC-link voltage.
2.7.1.1	Control Place Selection	-	Set based on active control place. Set 3 for I/O terminals. Set 2 for Fieldbus.
2.1.14	DC-link Nominal Voltage	V	Defines nominal DC-link voltage which is used for scaling of the references of overvoltage or undervoltage limits and drooping.

Parameter menu index	Parameter name	Unit	Description
2.2.6.2	DC-Link Voltage Ref.	%	Defines DC-link reference in % of the nominal DC-link voltage.
2.2.4.6	Reactive Current Ref. Source	-	Set according to the desired reference. Set 0 for parameter. Set 1 for fieldbus. This parameter is optional.

5.3.2 Configuring Island Mode

Island mode is used for grid forming when Grid Converter is the only power generation source defining grid voltage and frequency.

1. Configure the following parameters.

Parameter menu index	Parameter name	Unit	Description
2.2.1.1	Operation Mode	-	Set to 0, Island Mode.
2.7.1.1	Control Place Selection	-	Set based on active control place. Set 3 for I/O terminals. Set 2 for Fieldbus.
2.2.2.1	Freq. Ref. Source	-	Set according to desired reference source. Set 0 for nominal value. Set 1 for fieldbus.
2.2.3.1	Voltage Ref. Source	-	Set according to desired reference source. Set 0 for nominal value. Set 1 for fieldbus.
2.6.4.9	MCB Closing Mode	-	Set either to 0, DC-Link Pre Charge Ready, or to 1, Start Command.

5.3.3 Configuring Droop Control (Microgrid Mode)

Droop control is used to balance load between parallel generating units.

1. Configure the following parameters.

Parameter menu index	Parameter name	Unit	Description
2.2.1.1	Operation Mode	-	Set to 1, Droop Control.
2.7.1.1	Control Place Selection	-	Set based on active control place. Set 3 for I/O terminals. Set 2 for Fieldbus.
2.2.2.1	Freq. Ref. Source	-	Set according to desired reference source. Set 0 for nominal value. Set 1 for fieldbus.
2.2.3.1	Voltage Ref. Source	-	Set according to desired reference source. Set 0 for nominal value. Set 1 for fieldbus.
2.2.2.14	Freq. Droop Gain	Hz	Defines the frequency droop curve. All the generating units must have the same value.

Parameter menu index	Parameter name	Unit	Description
2.2.3.15	Voltage Droop Gain	%	Defines the voltage droop curve. All the generating units must have the same value.
2.6.4.9	MCB Closing Mode	-	Set either to 0, DC-Link Pre Charge Ready, or to 1, Start Command.

2. Configure the digital potentiometer, if required.

5.3.4 Configuring Droop Control with Base Load

Droop with base load can be used to adjust the power output between parallel generating units independently when drooping is active.

1. Configure the following parameters.

Parameter menu index	Parameter name	Unit	Description
2.2.1.1	Operation Mode	-	Set to 2, Droop control with base load.
2.7.1.1	Control Place Selection	-	Set based on active control place. Set 3 for I/O terminals. Set 2 for Fieldbus.
2.2.2.1	Freq. Ref. Source	-	Set according to desired reference source. Set 0 for nominal value. Set 1 for fieldbus.
2.2.3.1	Voltage Ref. Source	-	Set according to desired reference source. Set 0 for nominal value. Set 1 for fieldbus.
2.2.2.14	Freq. Droop Gain	Hz	Defines the frequency droop curve. All the generating units must have the same value.
2.2.3.15	Voltage Droop Gain	%	Defines the voltage droop curve. All the generating units must have the same value.
2.2.4.1	Active Current Ref. Source	-	Set according to the desired reference source. Set 0 for Parameter. Set 1 for Fieldbus. Set 2 for Analog Input.
2.2.4.6	Reactive Current Ref. Source	-	Set according to the desired reference source. Set 0 for Parameter. Set 1 for Fieldbus.
2.6.4.9	MCB Closing Mode	-	Set either to 0, DC-Link Pre Charge Ready, or to 1, Start Command.

2. Configure the digital potentiometer, if required.

5.3.5 Configuring PQ-Control (Active and Reactive Power Control)

Direct power control is used when the power management system defines the power reference.

1. Configure the following parameters.

Parameter menu index	Parameter name	Unit	Description
2.2.1.1	Operation Mode	-	Set to 3: PQ Mode.
2.7.1.1	Control Place Selection	-	Set based on active control place. Set 3 for I/O terminals. Set 2 for Fieldbus.
2.2.4.1	Active Current Ref. Source	-	Set according to the desired reference source. Set 0 for Parameter. Set 1 for Fieldbus. Set 2 for Analog Input.
2.2.4.6	Reactive Current Ref. Source	-	Set according to the desired reference source. Set 0 for Parameter. Set 1 for Fieldbus.

5.3.6 Configuring the DC-Link Current/Power Control

The DC-link current/power control mode is used when the power management system controls the DC-link current or power directly with their own reference chains.

1. Configure the following parameters.

Parameter menu index	Parameter name	Unit	Description
2.2.1.1	Operation Mode	-	Set to 5: DC-Link Current.
2.7.1.1	Control Place Selection	-	Set based on active control place. Set 3 for I/O terminals. Set 2 for Fieldbus.
2.1.14	DC-link Nominal Voltage	V	Defines the nominal DC-link voltage used for scaling the references and overvoltage and undervoltage limits, as well as for drooping.
2.2.7.2	DC-Link Current Ref.	%	Defines the DC-link current reference in percentage of the nominal DC-link current.
2.2.4.6	Reactive Current Ref. Source	-	Set according to the desired reference source. Set 0 for Parameter. Set 1 for Fieldbus.

5.3.7 Configuring AC Current/Power Control

This task follows the same steps as the configuration of PQ-Control mode.

1. See 5.3.5 Configuring PQ-Control (Active and Reactive Power Control).

5.4 Configuring Short Term Current Injection

If there is a faulty device in the microgrid, set short term current injection to increase the short circuit current feeding capability to activate protective devices. Short term current injection is applicable for island, droop, droop with base load, and PQ-control modes.

1. Configure the following parameters.

Parameter menu index	Parameter name	Unit	Description
1.4.9.2	Short Term Current Limit	%	Defines the short-term current limits during the grid faults.
1.4.9.3	Short Term Current Time	s	Defines the short-term current injection duration during the grid faults.

5.5 Configuring DC-Link Voltage Limit Control

The iC7-Hybrid application enables setting the system DC-link voltage level via parameters. When units connected to the same DC link share the same nominal DC-link voltage level, the overvoltage and undervoltage controller limits, for example, can be set in a consistent way.

If parallel converters are connected to the same DC link, set up voltage droop parameters. DC-link voltage control uses the same reference scaling as over and undervoltage control.

1. Configure the following parameters.

Parameter menu index	Parameter name	Unit	Description
2.1.14	DC-link Nominal Voltage	V	Nominal voltage of the system DC link.
2.3.4.1.3	Undervoltage Limit	%	Limit control activation level in % of nominal DC-link voltage.
2.3.4.2.3	Overvoltage Limit	%	Limit control activation level in % of nominal DC-link voltage.
2.3.4.2.1	Overvoltage Control	-	Set 0 to disable overvoltage control. Set 1 to enable overvoltage control.
2.3.4.1.1	Undervoltage Control	-	Set 0 to disable undervoltage control. Set 1 to enable undervoltage control.

5.6 Configuring Main Circuit Breaker and Pre-Charging

Pre-charging of the DC-link capacitors is required before switching on main power to avoid a high inrush current. The pre-charging function uses the digital I/Os and relays of the control unit.

The pre-charging function requires auxiliary voltage for the control unit and the pre-charging circuit. In the standard configuration, the enclosure is equipped with main power (0/1), pre-charging mode (manual/auto), and switches.

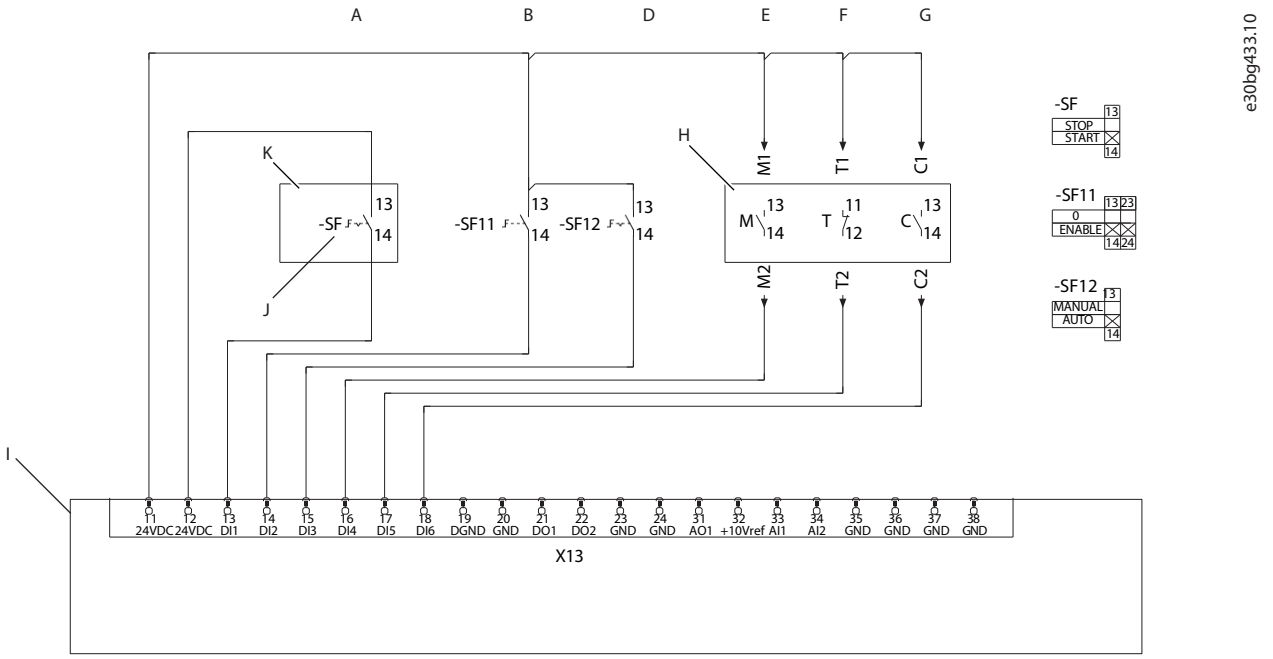


Figure 45: Pre-charging Control Circuit Diagram

A	AFE or GC remote control start/stop	**B**	Mains 0-enable
D	Pre-charging man-auto	**E**	Main input device status
F	Main input device tripped (circuit breaker)	**G**	Cooling supervision
H	Status/supervision	**I**	I/O and Relay Option OC7C1
J	AFE start/stop	**K**	Field connection

Consider the example wiring for pre-charging contactor and main circuit breaker. It is recommended to hard-wire auxiliary power through the main 0-enable switch or provide an alternative way to cut power to the coils.

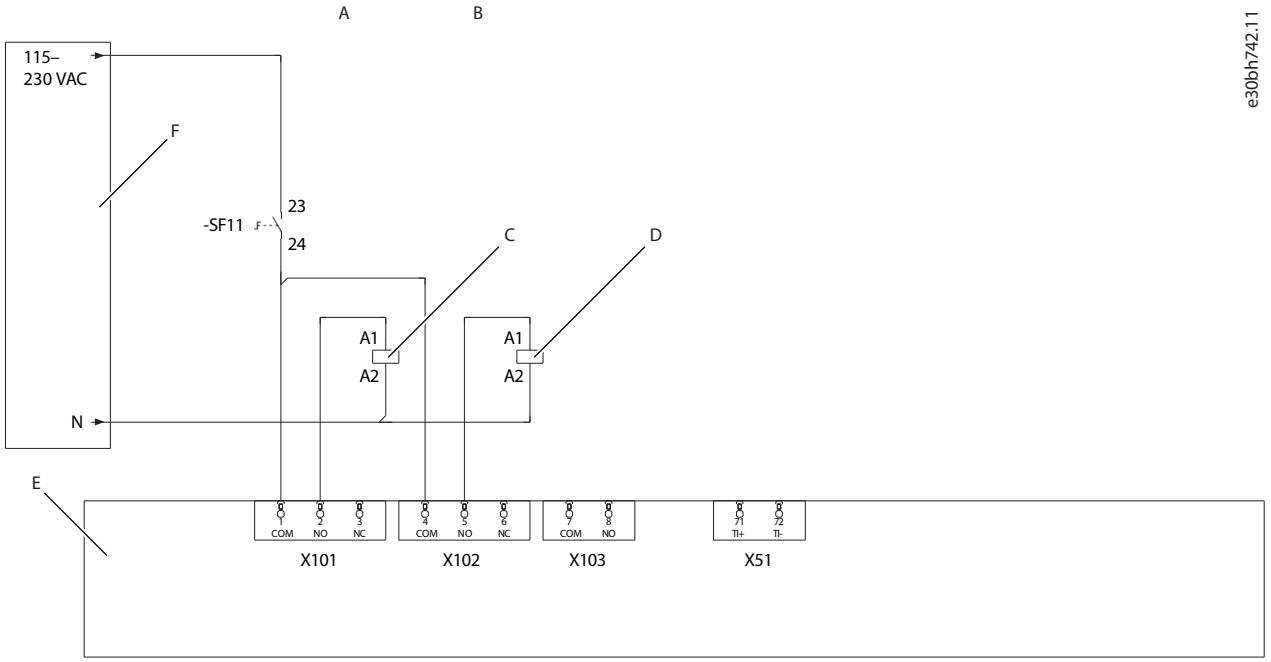


Figure 46: Relay outputs

A	Pre-charging contactor control	**B**	Main input device control
C	-QA6, Pre-charging contactor coil	**D**	-QA3, Mains contactor coil
E	I/O and Relay Option OC7C1	**F**	Short-circuit protected supply

1. Configure digital inputs for pre-charging and main circuit breaker.

Parameter menu index	Parameter name	Recommended setting
2.4.1.10	Switch On Enable Input	Set according to the I/O configuration. Set Mains as ***0-enable***. If mains is not used, set to ***1: true***.
2.4.1.11	Pre Charge Request Inp.	Set according to the I/O configuration. When pre-charging, set to ***man-auto***. If pre-charging is not used, set to ***0: false***.
2.4.1.13	MCB Feedback Close Input	Set according to the I/O configuration. If not used, set to ***0: false***.
2.4.1.15	MCB Tripped Input	Set according to the I/O configuration. If not used, set to ***0: false***.

2. Configure relay outputs for pre-charging and main circuit breaker.

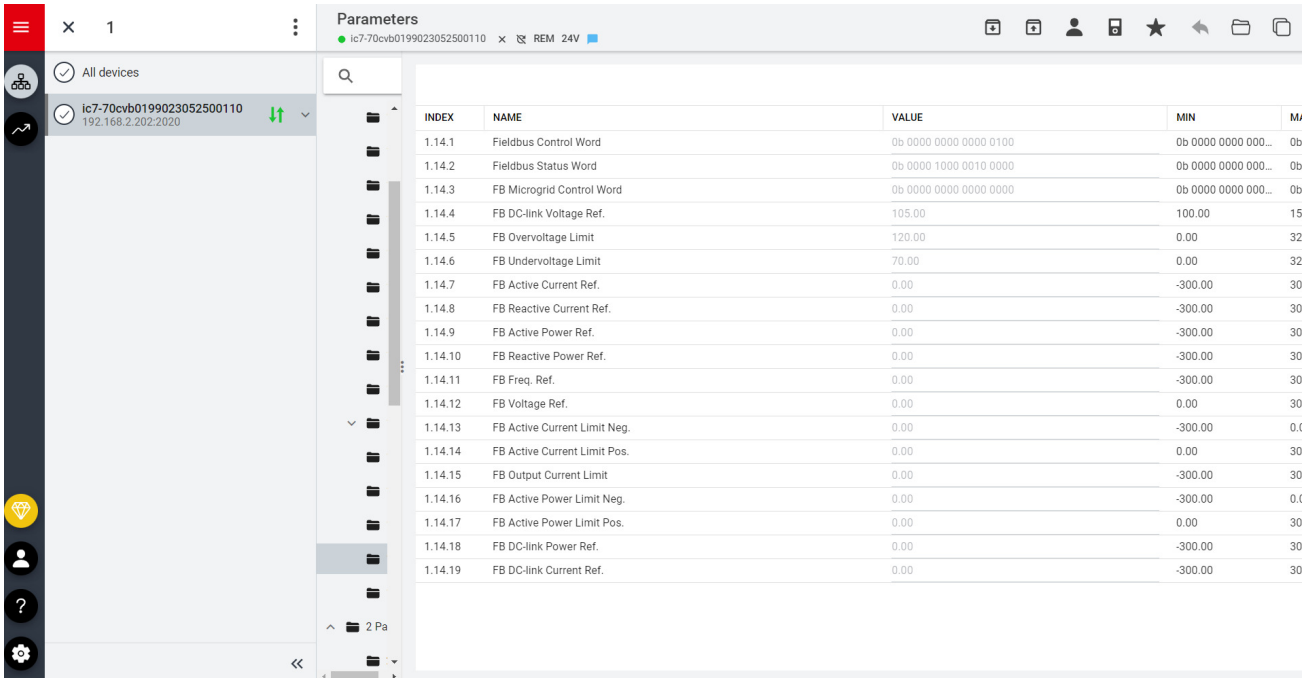
Parameter menu index	Parameter name	Recommended setting
2.5.1.26	Pre-Charge Request Output	Set according to the I/O configuration. If the pre-charging command is not used, set to ***0: false***.
2.5.1.28	MCB Close Output	Set according to the I/O configuration. If the main circuit breaker is not used, set to ***0: false***.

5.7 Datalogger

The Datalogger feature in MyDrive® Insight allows the monitoring and recording of various signals and related data for selected drives. Follow the steps below to access and use the Datalogger:

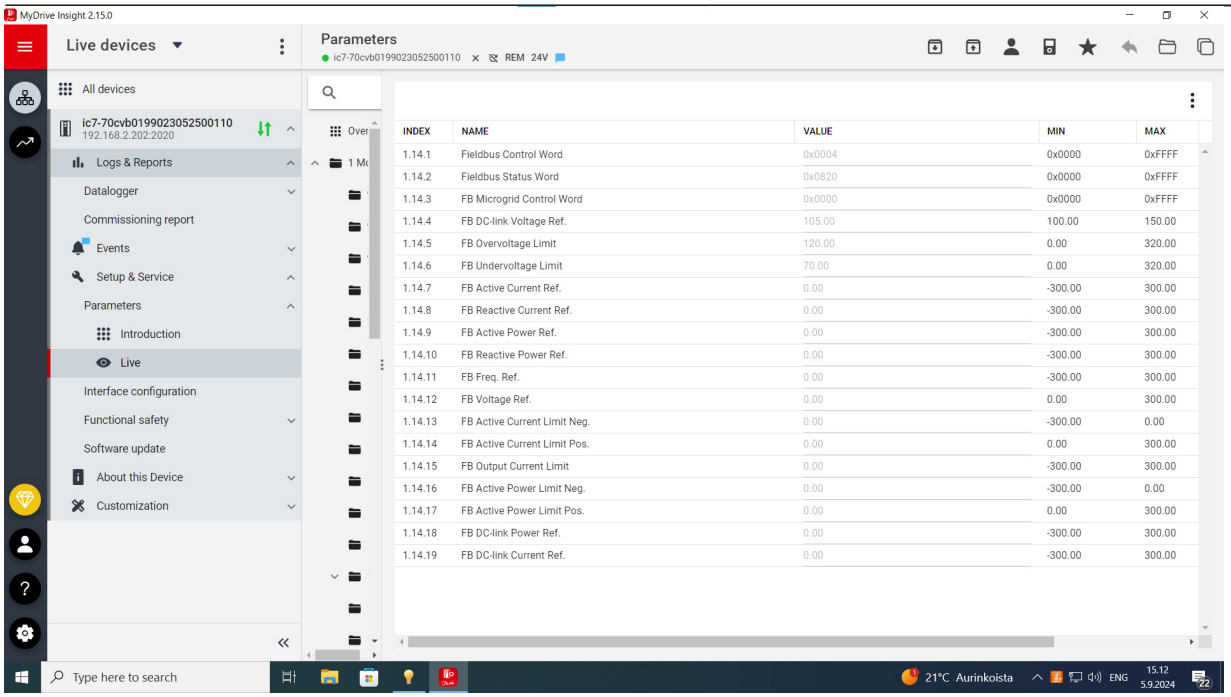
Step 1: Select the Drive

- Navigate to the MyDrive® Insight interface**.**
- In the main dashboard, locate and select the specific drive to monitor. This is typically done by clicking on the drive's name or icon.



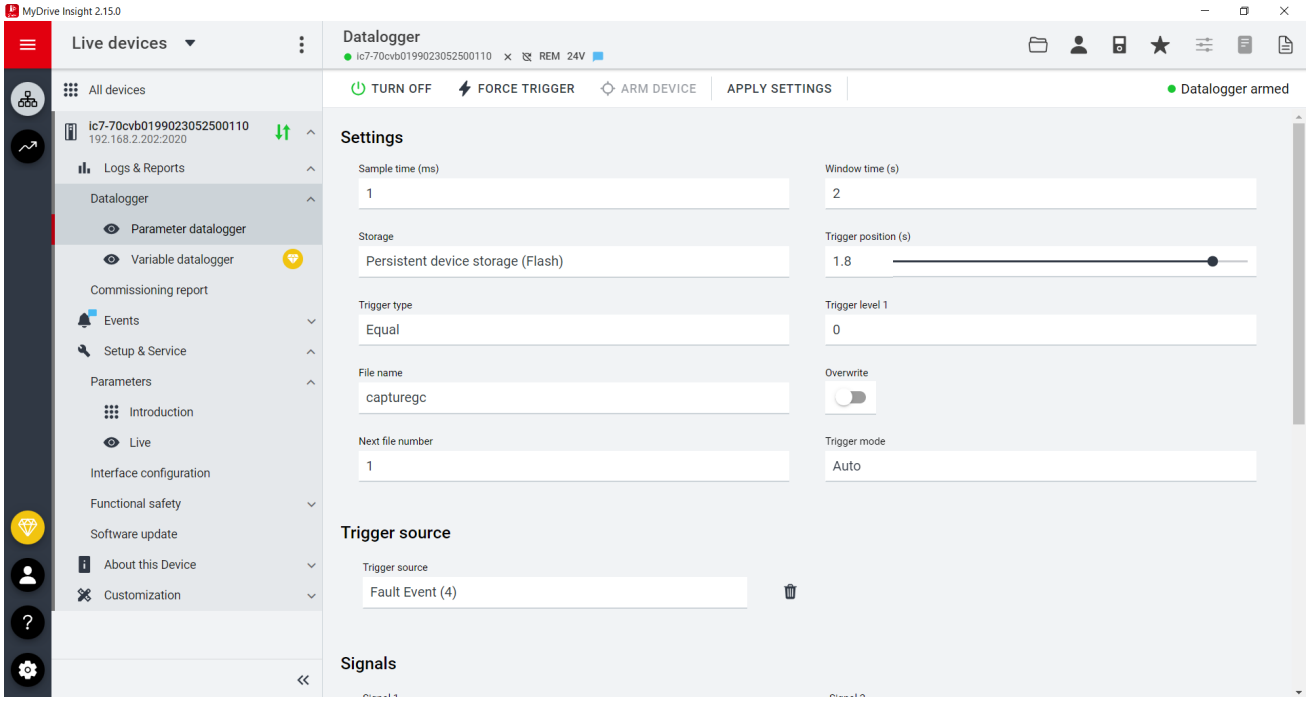
Step 2: Access the Graphs and Reports Section

- Once the drive is selected, navigate to the left-hand menu or the top menu bar (depending on the interface layout).
- Click on **Logs and Reports**. This section contains various tools for visualizing and analyzing drive data.



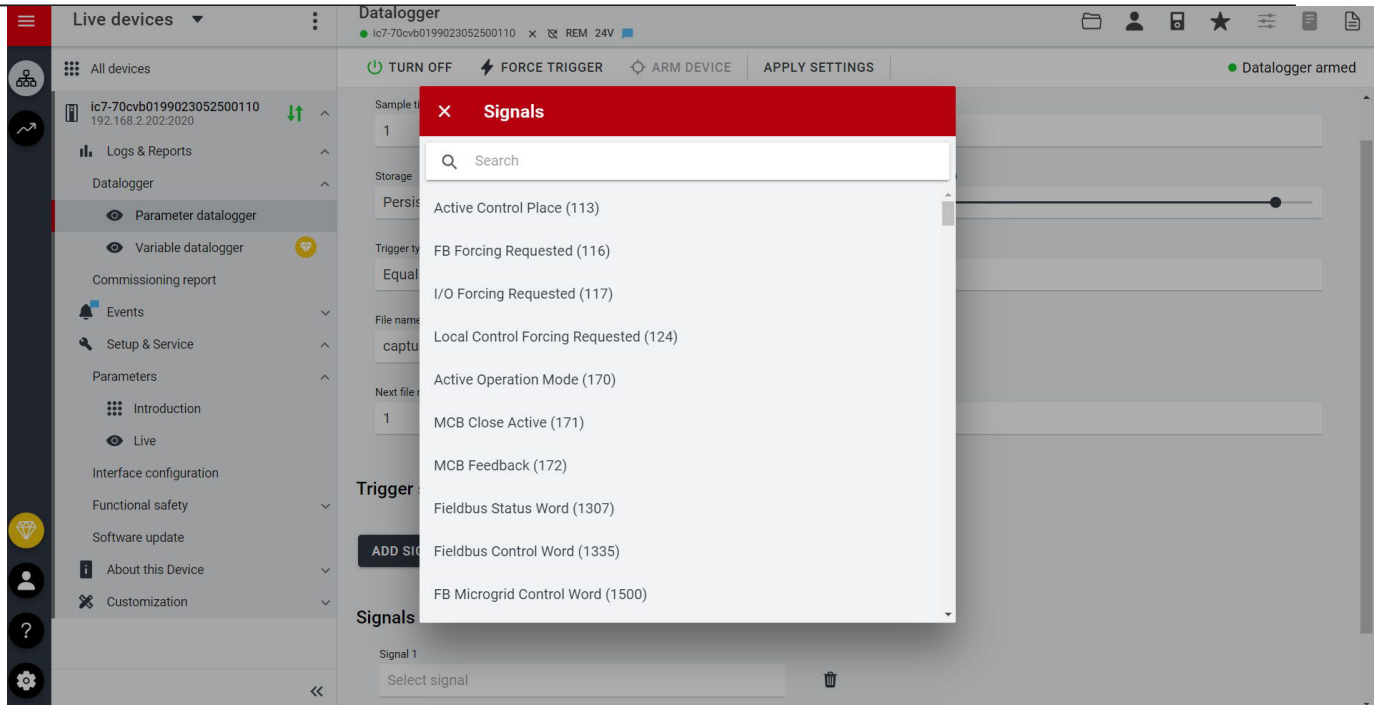
Step 3: Open the Datalogger

- In the Graphs and Reports section, locate and click on **Datalogger**.
- The Datalogger interface will open, displaying available signals and options for data logging.



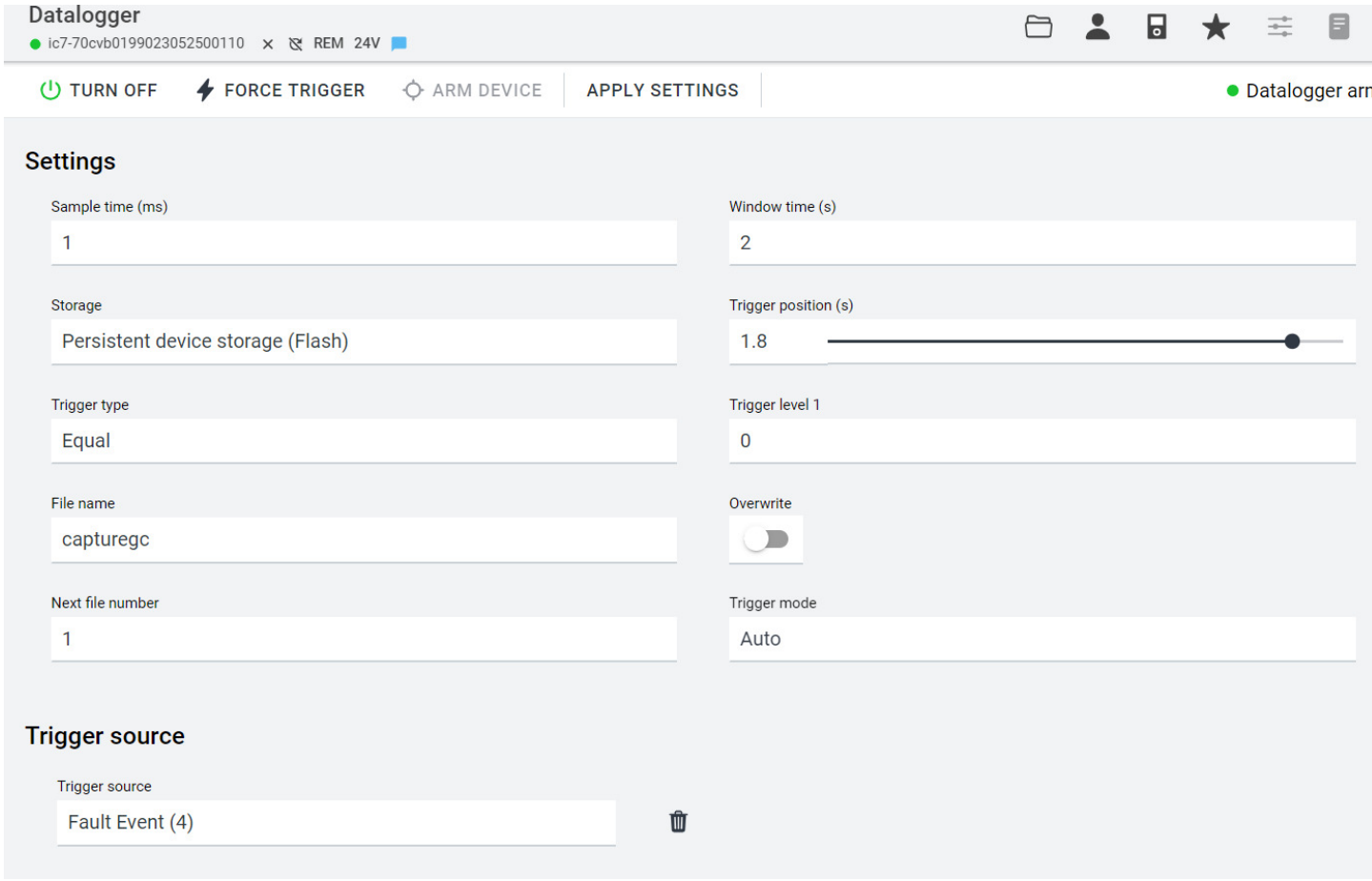
Step 4: Select Signals for Monitoring

- In the Datalogger interface, select the signals to monitor. These could include parameters like Grid Frequency, Active Current Ref %, Converter Output voltage and others, depending on what is available for the drive.
- Multiple signals can be selected for simultaneous monitoring.



Step 5: Configure Logging Parameters

- Set the desired storage location, sample time and duration. This determines how frequently data is recorded and for how long.
- There may also be options to set triggers or conditions for logging, such as starting the log when a certain event occurs.

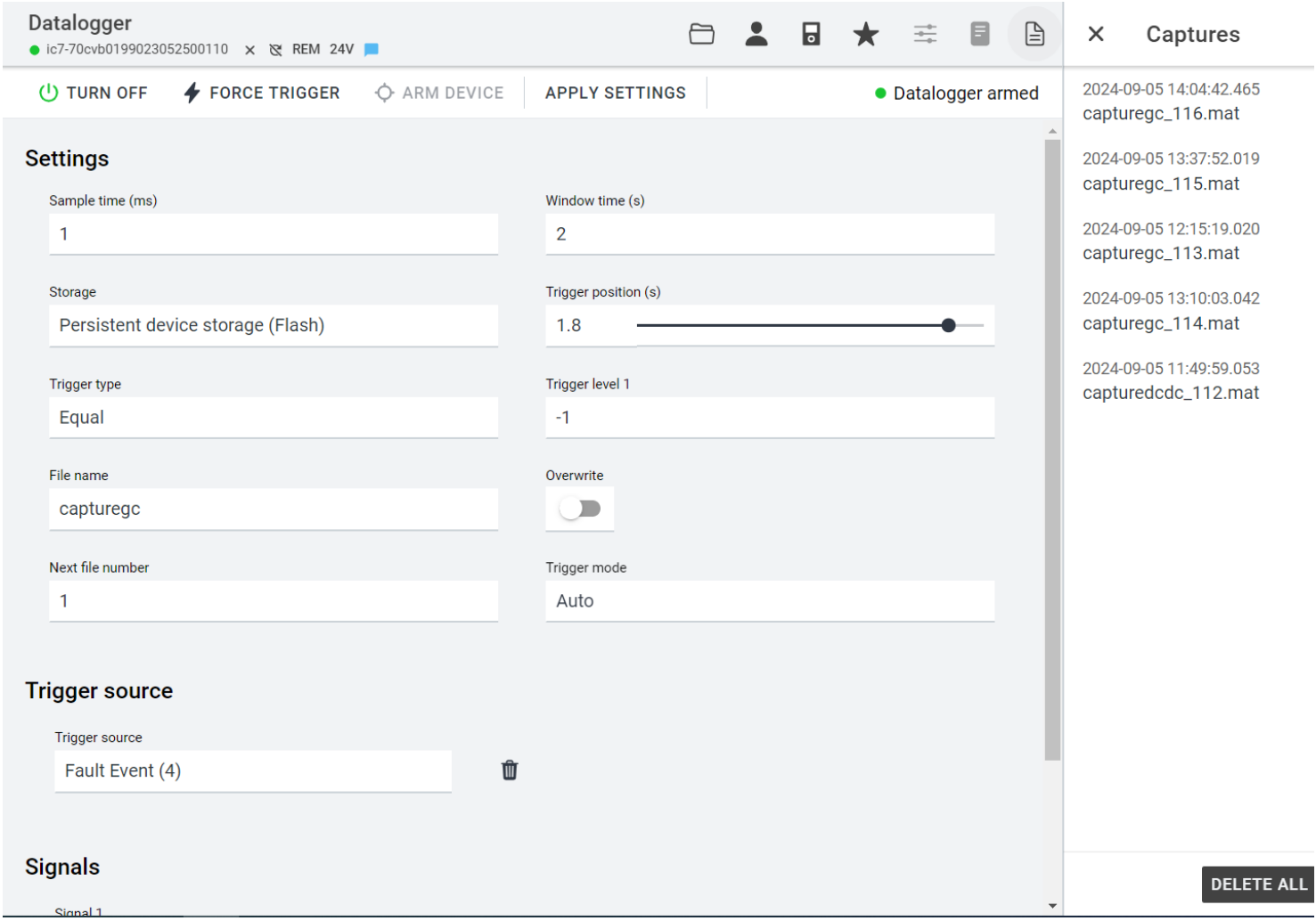


Step 6: Start Logging

- Once the signals and parameters are configured, click **Apply Setting and Arm Device** to begin the process.
- The system will now record the selected signals according to the settings.

Step 7: View and Analyze Data

- As data is logged, it is displayed in right side bar or chart within the Datalogger interface as shown in the following image. If the window is not visible, click on the Page icon as highlighted besides the **Captures** heading.
- It is possible to pause, zoom in, or export the data for further analysis or reporting.



Step 8: Save or Export Data

- After the logging session is complete, the data can be saved directly within MyDrive® Insight for future reference.
- Alternatively, export the logged data to a selectable file format (CSV or Excel, for example) for external analysis or record-keeping.

6 Menu Structure

6.1 Understanding Application Menu Structure

The menu structure has been designed to make the commissioning easy and user-friendly.

The menu is divided into two parts: Group 1. Monitoring has all the readouts and status words. The rest of the groups are used to configure the application parameters based on different configuration examples, and to configure all the features.

6.1.1 Application Menu Structure

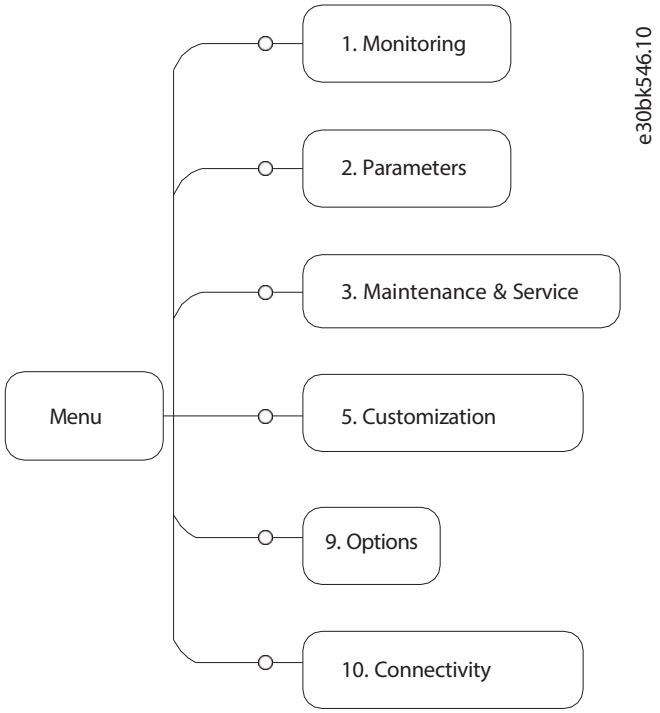


Figure 64: Menu Structure

Table 24: Parameter Groups

Menu index	Parameter group name	Description
1	Monitoring	Contains parameters for the configuring, monitoring, and controlling of the DC source.
2	Parameters	Contains parameters for the configuring, monitoring, and controlling of the power conversion of the converter. The menu makes it possible to configure protection settings of the power unit and settings for the DC bus.
3	Maintenance & Service	Contains parameters for configuring the filters.
5	Customization	Contains application specific parameters.
9	Options	Contains parameters for configuring IO & Relay, Temperature Measurement and Voltage Measurement.
10	Connectivity	Contains parameters for configuring the inbuilt and optional communications of the converter system.

This chapters contain tables presenting the basic attributes of each parameter available in the application software. Each chapter represents a single sub-group within the menu structure.

The tables have the following format:

Index	Name	Num	Min	Max	Default	Unit	Reso	Handling Type	Data Type
1.2.3.4.5	Parameter Name	1234	-10.0[1]	10.0[1]	0.0	Hz	0.01	Config	REAL
6.7.8	Array Parameter Name	5678	0	5	[1,2]		1	Config	UINT

[1]: Value depends on the power unit specification.

- Index: shows the location of the parameter within the menu structure.
- Name: shows the parameter name.
- Num: shows the parameter number.
- Min: shows the minimum value that the parameter can have. For arrays the single given value applies to all array elements.
- Max: shows the maximum value that the parameter can have. For arrays the single given value applies to all array elements.
- Default: shows the value that the parameter has with factory default settings. For arrays each element value is shown comma-separated within square brackets.
- Unit: shows the unit symbol of the parameter. Nothing is shown if the parameter is unitless.
- Reso: shows the resolution or display/edit precision of the parameter.
- Handling Type: shows whether the drive handles the parameter as a constantly changing *process* value or an infrequently changed *configuration* value. Use this field as a guide for evaluating how often to write to parameters when creating custom fieldbus configurations.
- Data type: shows the IEC 61131 elementary data type of the parameter.
- Possible references within any field will note special conditions that are explained after the table.

6.1.2 Understanding Data Types

The following is an overview of the data types used in the iC7 application software. They are IEC 61131 elementary data types.

Data type	Description	Size (Bits)	Range
BOOL	Boolean	1	0…1
INT	Integer	16	-32,768...32,767
DINT	Double Integer	32	-2,147,483,648 up to 2,147,483,647
USINT	Unsigned short integer	8	0 up to 255
UINT	Unsigned integer	16	0 up to 65,535
UDINT	Unsigned double integer	32	0 up to 4,294,967,295
REAL	Real numbers	32	-3.402823466 E+38 (approximately 7 digits) up to -1.175494351E-38 (approximately 7 digits) and +1.175494351 E-38 (approximately7 digits) up to +3.402823466 E+38 (approximately 7 digits)
WORD	Bit string of length 16	16	0...65,535 (16#00...16#FFFF)
STRING	Sequence of characters	N/A	1 Byte per character
ULINT	Unsigned long integer	64	0 - 18446744073709551615
DATE_AND_TIME	Date and time information	64	N/A

6.2 Monitoring

6.2.1 Basic Monitoring

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
1.1.1	Grid Voltage	9040	0.0	3.4e+38	0.0	V	0.1	Process	REAL
1.1.2	Grid Frequency	9041	-3.4e+38	3.4e+38	0.0	Hz	0.01	Process	REAL
1.1.3	Grid Power Factor	9053	-1.0	1.0	0.0		0.01	Process	REAL
1.1.4	DC-link Current	5115	-6000.0	6000.0	0.0	A	1	Process	REAL
1.1.5	DC-link Voltage	9044	0.0	3.4e+38	0.0	V	0.1	Process	REAL
1.1.6	DC-link Power	5117	-3.4e+38	3.4e+38	0.0	kW	1	Process	REAL
1.1.7	Application Status Word 1	6201	0x0	0xffff	0x0		1	Process	WORD
1.1.8	Application Status Word 2	6202	0x0	0xffff	0x0		1	Process	WORD
1.1.9	Fault Status Word 1	6203	0x0	0xffff	0x0		1	Process	WORD
1.1.10	Fault Status Word 2	6204	0x0	0xffff	0x0		1	Process	WORD
1.1.11	Warning Status Word 1	6205	0x0	0xffff	0x0		1	Process	WORD
1.1.12	Warning Status Word 2	6206	0x0	0xffff	0x0		1	Process	WORD
1.1.13	Last Fault Number	1610	0	65535	0		1	Process	UINT
1.1.14	Last Warning Number	1609	0	65535	0		1	Process	UINT
1.1.15	Grid Control Status Word	6540	0x0	0xffff	0x0		1	Process	WORD
1.1.16	Grid Control Ready Status Word	5096	0x0	0xffff	0x0		1	Process	WORD
1.1.17	Application Ready Status Word	6525	0x0	0xffff	0x0		1	Process	WORD
1.1.18	Limit Control Status Word	9077	0x0	0xffff	0x0		1	Process	WORD
1.1.19	DC-link Nominal Current	5120	0.0	3.4e+38	0.0	A	0.01	Process	REAL
1.1.20	Grid Nominal Current Converter-Side	6505	0.0	3.4e+38	0.0	A	0.01	Process	REAL
1.1.21	Grid Nominal Voltage Converter-Side	6504	0.0	1e+05	0.0	V	0.01	Process	REAL
1.1.22	Grid Nominal Power	5119	0.0	1e+07	4e+05	kVA	0.01	Process	REAL
1.1.23	Ext. Grid Status Word	6594	0x0	0xffff	0x0		1	Process	WORD

6.2.2 Control Mode and Reference Monitoring

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
1.2.1	Active Operation Mode	170	0	6	0		1	Process	UINT
1.2.2	Grid Control Mode Selection Status Word	9078	0x0	0xffff	0x0		1	Process	WORD
1.2.3	Frequency Ref.	1718	-2000.0	2000.0	0.0	Hz	0.01	Process	REAL
1.2.4	Voltage Ref.	6530	0.0	1000.0	100.0	%	0.01	Process	REAL
1.2.5	Active Current Ref.	2874	-1000.0	1000.0	0.0	%	0.1	Process	REAL
1.2.6	Reactive Current Ref.	2875	-3.4e+38	3.4e+38	0.0	%	0.1	Process	REAL
1.2.7	Active Power Ref.	2876	-1000.0	1000.0	0.0	%	0.1	Process	REAL
1.2.8	Reactive Power Ref.	2877	-300.0	300.0	0.0	%	0.1	Process	REAL
1.2.9	DC-link Current Ref. Actual	6141	-300.0	300.0	0.0	%	0.01	Process	REAL
1.2.10	DC-link Voltage Ref. Actual	6543	-16777216.0	16777216.0	0.0	%	0.01	Process	REAL
1.2.11	DC-link Power Ref. Actual	7693	-300.0	300.0	0.0	%	0.01	Process	REAL

6.2.3 Limit Monitoring

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
1.3.1	Limit Control Status Word	9077	0x0	0xffff	0x0		1	Process	WORD
1.3.2	Current Limit (Actl.)	2882	-3.4e+38	3.4e+38	150.0	%	0.1	Process	REAL
1.3.3	Neg. Active Current Limit (Actl.)	2878	-1000.0	0.0	-300.0	%	0.1	Process	REAL
1.3.4	Pos. Active Current Limit (Actl.)	2880	0.0	1000.0	300.0	%	0.1	Process	REAL
1.3.5	Neg. Active Power Limit (Actl.)	2879	-1000.0	0.0	-300.0	%	0.1	Process	REAL

1.3.6	Pos. Active Power Limit (Actl.)	2881	0.0	1000.0	300.0	%	0.1	Process	REAL
1.3.7	Overvoltage Control Limit	6544	-16777216.0	16777216.0	796.5	V	0.01	Process	REAL
1.3.8	Undervoltage Control Limit	6546	100.0	1300.0	100.0	V	0.01	Process	REAL

6.2.4 Start and Stop Monitoring

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
1.4.1	Pre-Charge Active	6561	0	1	0		1	Process	INT
1.4.2	Pre-Charge Ready	6562	0	1	0		1	Process	INT
1.4.3	MCB Close Active	171	0	1	0		1	Process	INT
1.4.4	MCB Feedback	172	0	1	0		1	Process	INT

6.2.5 Control Place Monitoring

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
1.5.1	Active Control Place	113	0	3	0		1	Process	UINT
1.5.2	FB Forcing Requested	116	0	1	0		1	Process	BOOL
1.5.3	I/O Forcing Requested	117	0	1	0		1	Process	BOOL
1.5.4	Local Control Forcing Requested	124	0	1	0		1	Process	BOOL

6.2.6 Converter Output Monitoring

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
1.6.1	Converter Output Current	9000	0.0	3.4e+38	0.0	A	1	Process	REAL
1.6.2	Converter Output Current %	9001	0.0	200.0	0.0	%	0.01	Process	REAL
1.6.3	Converter Output Voltage	9005	0.0	3.4e+38	0.0	V	0.1	Process	REAL
1.6.4	Converter Output Frequency	9015	-3.4e+38	3.4e+38	0.0	Hz	0.01	Process	REAL

6.2.7 Grid Monitoring

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
1.7.1	Grid Frequency	9041	-3.4e+38	3.4e+38	0.0	Hz	0.01	Process	REAL
1.7.2	Grid Voltage	9040	0.0	3.4e+38	0.0	V	0.1	Process	REAL
1.7.3	Grid Voltage Imbalance	9047	0.0	100.0	0.0	%	0.01	Process	REAL
1.7.4	Grid Current	9060	0.0	3.4e+38	0.0	A	1	Process	REAL
1.7.5	Grid Current %	9061	-1000.0	1000.0	0.0	%	0.1	Process	REAL
1.7.6	Grid Active Current %	9062	-1000.0	1000.0	0.0	%	0.1	Process	REAL
1.7.7	Grid Reactive Current %	9063	-300.0	300.0	0.0	%	0.1	Process	REAL
1.7.8	Grid Active Power	9064	-3.4e+38	3.4e+38	0.0	kW	1	Process	REAL
1.7.9	Grid Active Power %	9065	-1000.0	1000.0	0.0	%	0.1	Process	REAL
1.7.10	Grid Reactive Power	9051	-3.4e+38	3.4e+38	0.0	kVA	1	Process	REAL
1.7.11	Grid Reactive Power %	9052	-1000.0	1000.0	0.0	%	0.1	Process	REAL
1.7.12	Grid Power Factor	9053	-1.0	1.0	0.0		0.01	Process	REAL

6.2.8 DC-Link Monitoring

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
1.8.1	DC-link Voltage	9044	0.0	3.4e+38	0.0	V	0.1	Process	REAL
1.8.2	DC-link Voltage %	6542	0.0	200.0	0.0	%	0.01	Process	REAL
1.8.3	DC-link Current	5115	-6000.0	6000.0	0.0	A	1	Process	REAL
1.8.4	DC-link Current %	5116	-300.0	300.0	0.0	%	0.01	Process	REAL
1.8.5	DC-link Power	5117	-3.4e+38	3.4e+38	0.0	kW	1	Process	REAL
1.8.6	DC-link Power %	5118	-300.0	300.0	0.0	%	0.01	Process	REAL

6.2.9 Converter Control Monitoring

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
1.9.1	Actual Switching Frequency	2923	0.0	16000.0	0.0	Hz	0.01	Process	REAL
1.9.2	Modulation Index	5101	0.0	2.0	0.0		0.01	Process	REAL
1.9.3	Control Unit Temperature	2952	-50.0	200.0	0.0	°C	0.1	Process	REAL

6.2.10 Protection Monitoring

6.2.10.1 Measured Temp. Protection Status

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
1.10.1.1	Protection 1 Temp.	5200	-300.0	300.0	0.0	°C	0.01	Process	REAL
1.10.1.2	Protection 2 Temp.	5201	-300.0	300.0	0.0	°C	0.01	Process	REAL
1.10.1.3	Protection 3 Temp.	5202	-300.0	300.0	0.0	°C	0.01	Process	REAL
1.10.1.4	Protection 4 Temp.	5203	-300.0	300.0	0.0	°C	0.01	Process	REAL
1.10.1.5	Protection 5 Temp.	5204	-300.0	300.0	0.0	°C	0.01	Process	REAL
1.10.1.6	Protection 6 Temp.	5205	-300.0	300.0	0.0	°C	0.01	Process	REAL
1.10.1.7	Protection 7 Temp.	5273	-300.0	300.0	0.0	°C	0.01	Process	REAL
1.10.1.8	Protection 8 Temp.	5274	-300.0	300.0	0.0	°C	0.01	Process	REAL
1.10.1.9	Protection 9 Temp.	5275	-300.0	300.0	0.0	°C	0.01	Process	REAL
1.10.1.10	Protection 10 Temp.	5276	-300.0	300.0	0.0	°C	0.01	Process	REAL

6.2.10.2 Supervision Monitoring

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
1.10.2.1	Grid Supervision Status Word	9054	0x0	0xffff	0x0		1	Process	WORD

6.2.11 Custom Status Word Monitoring

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
1.11.1	Custom Status Word	2410	0x0	0xffff	0x0		1	Process	WORD

6.2.12 Power Unit Monitoring

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
1.12.1	Power Capacity	2836	0.0	100.0	100.0	%	1	Process	REAL
1.12.2	Unit Nominal Voltage	2830	0.0	3.4e+38	400.0	V	0.01	Process	REAL
1.12.3	Unit Nominal Current	2831	0.0	3.4e+38	23.0	A	0.01	Process	REAL
1.12.4	Heat Sink Temperature	2950	-50.0	200.0	0.0	°C	0.1	Process	REAL

6.2.13 Cooling Fan Monitoring

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
1.13.1	Main Fan Speed	2931	0	32767	0	rpm	1	Process	INT
1.13.2	Internal Fan Speed	2926	0	32767	0	rpm	1	Process	INT

6.2.14 Fieldbus Process Data Monitoring

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
1.14.1	Fieldbus Control Word	1335	0x0	0xffff	0x4		1	Process	WORD
1.14.2	Fieldbus Status Word	1307	0x0	0xffff	0x0		1	Process	WORD
1.14.3	FB Microgrid Control Word	1500	0x0	0xffff	0x0		1	Process	WORD
1.14.4	FB DC-link Voltage Ref.	6533	100.0	150.0	105.0	%	0.01	Process	REAL
1.14.5	FB Overvoltage Limit	4512	0.0	320.0	120.0	%	0.01	Process	REAL
1.14.6	FB Undervoltage Limit	4510	0.0	320.0	70.0	%	0.01	Process	REAL
1.14.7	FB Active Current Ref.	1501	-300.0	300.0	0.0	%	0.01	Process	REAL
1.14.8	FB Reactive Current Ref.	1502	-300.0	300.0	0.0	%	0.01	Process	REAL

1.14.9	FB Active Power Ref.	1504	-300.0	300.0	0.0	%	0.01	Process	REAL
1.14.10	FB Reactive Power Ref.	1505	-300.0	300.0	0.0	%	0.01	Process	REAL
1.14.11	FB Freq. Ref.	1506	-300.0	300.0	0.0	Hz	0.01	Process	REAL
1.14.12	FB Voltage Ref.	1508	0.0	300.0	0.0	%	0.01	Process	REAL
1.14.13	FB Active Current Limit Neg.	1509	-300.0	0.0	0.0	%	0.01	Process	REAL
1.14.14	FB Active Current Limit Pos.	1510	0.0	300.0	0.0	%	0.01	Process	REAL
1.14.15	FB Output Current Limit	1511	-300.0	300.0	0.0	%	0.01	Process	REAL
1.14.16	FB Active Power Limit Neg.	1512	-300.0	0.0	0.0	%	0.01	Process	REAL
1.14.17	FB Active Power Limit Pos.	1513	0.0	300.0	0.0	%	0.01	Process	REAL
1.14.18	FB DC-link Power Ref.	7690	-300.0	300.0	0.0	%	0.01	Process	REAL
1.14.19	FB DC-link Current Ref.	6139	-300.0	300.0	0.0	%	0.01	Process	REAL

6.2.15 I/O and Relay Status

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
9.3.1	Digital Input Bit Word	1614	0x0	0xffff	0x0		1	Process	WORD
9.3.2	Digital Output Bit Word	1615	0x0	0xffff	0x0		1	Process	WORD
9.3.3	T31 Analog Output Value	1613	-20.0	20.0	0.0		0.01	Process	REAL
9.3.4	T33 Analog Input Value	1611	-20.0	20.0	0.0		0.01	Process	REAL
9.3.5	T34 Analog Input Value	1612	-20.0	20.0	0.0		0.01	Process	REAL

6.2.16 Temperature Measurement Status

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
9.3.2	T4 Temperature Value	4040	-1000.0	1000.0	0.0	°C	1	Process	REAL
9.3.3	T8 Temperature Value	4041	-1000.0	1000.0	0.0	°C	1	Process	REAL
9.3.4	T12 Temperature Value	4042	-1000.0	1000.0	0.0	°C	1	Process	REAL
9.3.5	T16 Temperature Value	4043	-1000.0	1000.0	0.0	°C	1	Process	REAL
9.3.6	T20 Temperature Value	4044	-1000.0	1000.0	0.0	°C	1	Process	REAL

6.2.17 Voltage Measurement Status

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
9.3.1	X52 Voltage	4086	0.0	10000.0	0.0	V	0.1	Process	REAL
9.3.2	X52 Frequency	4087	-400.0	400.0	0.0	Hz	0.01	Process	REAL
9.3.3	X52 Phase Diff.	4088	-180.0	180.0	0.0	°	1	Process	REAL
9.3.4	X52 Voltage L1	4082	-10000.0	10000.0	0.0	V	0.1	Process	REAL
9.3.5	X52 Voltage L3	4083	-10000.0	10000.0	0.0	V	0.1	Process	REAL
9.3.6	X53 Voltage	4089	0.0	10000.0	0.0	V	0.1	Process	REAL
9.3.7	X53 Frequency	4090	-400.0	400.0	0.0	Hz	0.01	Process	REAL
9.3.8	X53 Phase Diff.	4091	-180.0	180.0	0.0	°	1	Process	REAL
9.3.9	X53 Voltage L1	4084	-10000.0	10000.0	0.0	V	0.1	Process	REAL
9.3.10	X53 Voltage L3	4085	-10000.0	10000.0	0.0	V	0.1	Process	REAL

6.3 Parameters

6.3.1 Basic Parameters

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.1.1	Grid Nominal Frequency	6536	0.0	2000.0	50.0	Hz	0.01	Configuration	REAL
2.1.2	Grid Nominal Voltage	6537	-3.4e+38	3.4e+38	690.0	V	0.1	Configuration	REAL
2.1.3	Grid Nominal Current	6538	-3.4e+38	3.4e+38	416.0	A	0.01	Configuration	REAL
2.1.4	Grid Voltage Feedback Source	6539	0	2	0		1	Configuration	UINT
2.1.5	Filter Voltage Feedback Source	6541	0	2	0		1	Configuration	UINT
2.1.6	Transformer Grid-Side Voltage	6123	1.0	1e+05	690.0	V	0.01	Configuration	REAL
2.1.7	Transformer Converter-Side Voltage	6124	1.0	1e+05	690.0	V	0.01	Configuration	REAL
2.1.8	Transformer Phase Shift	6125	-180.0	180.0	0.0	°	1	Configuration	REAL

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.1.9	Transformer Nominal Power	6126	0.0	1e+05	0.0	kVA	0.01	Configuration	REAL
2.1.10	Transformer Nominal Frequency	6127	1.0	2000.0	50.0	Hz	1	Configuration	REAL
2.1.11	Transformer Short-Circuit Impedance	6128	0.0	50.0	0.0	%	0.01	Configuration	REAL
2.1.12	Transformer Nom. Load Losses	6129	0.0	1000.0	0.0	kW	0.01	Configuration	REAL
2.1.13	Grid Voltage Feedback Location	6133	0	1	0		1	Configuration	UINT
2.1.14	DC-link Nominal Voltage	2834	0.0	1500.0	0.0	V	0.01	Configuration	REAL
2.1.15	Unit Voltage Class	2832	1	4	1		1	Configuration	UINT
2.1.16	Overload Mode	2833	0	3	2		1	Configuration	UINT
2.1.17	Current/Power Positive Direction	2947	0	1	0		1	Configuration	UINT
2.1.18	Paralleling Sync. Mode	9654	0	2	0		1	Configuration	UINT

6.3.2 Control Mode and References

6.3.2.1 Control Mode

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.2.1.1	Operation Mode	161	0	6	4		1	Configuration	UINT
2.2.1.2	Converter Reference Mode	163	0	1	0		1	Configuration	UINT
2.2.1.3	Harmonic Compensation Mode	4998	0	2	0		1	Configuration	UINT

6.3.2.2 Grid Frequency Reference

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.2.2.1	Freq. Ref. Source	5050	0	1	0		1	Configuration	UINT
2.2.2.2	Minimum Freq. Ref.	5051	25.0	75.0	45.0	Hz	0.1	Configuration	REAL
2.2.2.3	Maximum. Freq. Ref.	5052	25.0	75.0	66.0	Hz	0.1	Configuration	REAL
2.2.2.4	Freq. Increase. Input	5053	0	29999	0		1	Configuration	UINT
2.2.2.5	Freq. Decrease. Input	5054	0	29999	0		1	Configuration	UINT
2.2.2.6	Freq. Reset Input	5055	0	29999	0		1	Configuration	UINT
2.2.2.7	Freq. Ref. Offset	5056	-5.0	5.0	0.0	Hz	0.1	Configuration	REAL
2.2.2.8	Freq. Ref. Adjust Rate	5057	0.001	10.0	0.05	HertzPerSecond	0.1	Retain. Proc.	REAL
2.2.2.9	Max. Freq. Ref. Adjust	5058	0.0	25.0	2.0	Hz	0.1	Configuration	REAL
2.2.2.10	Freq. Ref. Reset Stop State Value	5059	0	2	1		1	Configuration	UINT
2.2.2.11	Freq. Ref. Reset I/O. Value	5060	0	2	1		1	Configuration	UINT
2.2.2.12	Freq.Ref. Reset AFE Mode Value	5061	0	2	1		1	Configuration	UINT
2.2.2.13	Freq. Ramp Time	5062	0.0	10000.0	5.0	s	0.1	Configuration	REAL
2.2.2.14	Freq. Droop Gain	5063	0.0	100.0	1.0	Hz	0.1	Configuration	REAL
2.2.2.15	Freq. Droop Tc	5064	0.0	10000.0	0.005	s	0.001	Configuration	REAL
2.2.2.16	Freq. Drooping Base Load Scale	5065	0.0	1000.0	100.0	%	0.1	Configuration	REAL

6.3.2.3 Grid Voltage Reference

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.2.3.1	Voltage Ref. Source	5066	0	1	0		1	Configuration	UINT
2.2.3.2	Min. Voltage Ref.	5067	50.0	100.0	80.0	%	0.1	Configuration	REAL
2.2.3.3	Max. Voltage Ref.	5068	100.0	150.0	120.0	%	0.1	Configuration	REAL
2.2.3.4	Voltage Incr. Input	5069	0	29999	0		1	Configuration	UINT
2.2.3.5	Voltage Decr. Input	5070	0	29999	0		1	Configuration	UINT
2.2.3.6	Voltage Reset Input	5071	0	29999	0		1	Configuration	UINT
2.2.3.7	Voltage Ref. Offset	5072	-20.0	20.0	0.0	%	0.1	Configuration	REAL
2.2.3.8	Voltage Ref. Adjust Rate	5073	0.01	10.0	0.1	PercentPerSecond	0.1	Configuration	REAL
2.2.3.9	Max. Voltage Ref. Adjust	5074	0.0	20.0	2.0	%	0.1	Configuration	REAL
2.2.3.10	Voltage Ref. Reset Stop State Value	5075	0	2	1		1	Configuration	UINT
2.2.3.11	Voltage Ref. Reset I/O. Value	5076	0	2	1		1	Configuration	UINT
2.2.3.12	Voltage Ref. Reset AFE Mode Value	5077	0	2	1		1	Configuration	UINT
2.2.3.13	Voltage Ramp Time	5078	0.0	10000.0	0.1	s	0.1	Configuration	REAL
2.2.3.14	Field Weakning Point Freq.	5079	0.0	2000.0	45.0	Hz	0.1	Configuration	REAL
2.2.3.15	Voltage Droop Gain	5085	0.0	100.0	10.0	%	0.1	Configuration	REAL

2.2.3.16	Voltage Droop Tc	5086	0.0	10000.0	0.005	s	0.001	Configuration	REAL
2.2.3.17	Voltage Drooping Base Load Scale	5087	0.0	10000.0	100.0	%	0.1	Configuration	REAL

6.3.2.4 Grid Current Reference

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.2.4.1	Active Current Ref. Source	245	0	2	0		1	Configuration	UINT
2.2.4.2	Active Current Ref.	230	-300.0	300.0	0.0	%	0.01	Configuration	REAL
2.2.4.3	Active Current Ref. Ramp Rate Increasing	231	-1.0	1000.0	100.0	PercentPerSecond	0.001	Retain. Proc.	REAL
2.2.4.4	Active Current Ref. Ramp Rate Decreasing	247	-1.0	1000.0	100.0	PercentPerSecond	0.001	Retain. Proc.	REAL
2.2.4.5	Active Current Ramp Reset	232	0	3	1		1	Configuration	UINT
2.2.4.6	Active Current Ref. Filter Tc	5099	0.001	1000.0	0.05	s	0.01	Configuration	REAL
2.2.4.7	Reactive Current Ref. Source	3021	0	1	0		1	Configuration	UINT
2.2.4.8	Reactive Current Ref.	233	-300.0	300.0	0.0	%	0.1	Configuration	REAL
2.2.4.9	Reactive Current Ramp Rate	234	-1.0	1000.0	100.0	PercentPerSecond	0.1	Configuration	REAL
2.2.4.10	Reactive Current Ref. Filter Tc	6570	0.0	1.0	0.05	s	0.01	Configuration	REAL
2.2.4.11	Active Current Ref. Analog Input	6571	0	29999	0		1	Configuration	UINT
2.2.4.12	Active Current Ref. Analog Input Min.	6572	-300.0	300.0	-100.0	%	0.01	Configuration	REAL
2.2.4.13	Active Current Ref. Analog Input Max.	6573	-300.0	300.0	100.0	%	0.01	Configuration	REAL

6.3.2.5 Grid Power Reference

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.2.5.1	Active Power Ref. Source	6550	0	2	0		1	Configuration	UINT
2.2.5.2	Active Power Ref.	235	-300.0	300.0	0.0	%	0.01	Configuration	REAL
2.2.5.3	Active Power Ref. Ramp Rate Increasing	236	-1.0	1000.0	100.0	PercentPerSecond	0.01	Configuration	REAL
2.2.5.4	Active Power Ref. Ramp Rate Decreasing	248	-1.0	1000.0	100.0	PercentPersecond	0.01	Configuration	REAL
2.2.5.5	Active Power Ramp Reset	237	0	3	1		1	Configuration	UINT
2.2.5.6	Reactive Power Ref. Source	6549	0	1	0		1	Configuration	UINT
2.2.5.7	Reactive Power Ref.	238	-300.0	300.0	0.0	%	0.1	Configuration	REAL
2.2.5.8	Reactive Power Ref. Ramp	239	-1.0	1000.0	100.0	PercentPerSecond	0.1	Configuration	REAL
2.2.5.9	Active Power Ref. Analog Input.	6593	0	29999	0		1	Configuration	UINT
2.2.5.10	Active Power Ref. Analog Input Min.	6591	-300.0	300.0	-100.0		1	Configuration	REAL
2.2.5.11	Active Power Ref. Analog Input Max.	6590	-300.0	300.0	100.0		1	Configuration	REAL

6.3.2.6 DC-link Voltage Reference

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.2.6.1	DC-link Voltage Ref. Source	2916	0	1	0		1	Configuration	UINT
2.2.6.2	DC-link Voltage Ref.	2910	100.0	150.0	105.0	%	0.1	Configuration	REAL
2.2.6.3	DC-link Voltage Ref. Offset	2914	-20.0	20.0	0.0	%	0.01	Configuration	REAL
2.2.6.4	DC-link Voltage Droop Gain	2912	0.0	10.0	0.0	%	0.01	Configuration	REAL
2.2.6.5	DC-link Voltage Ramp Rate	2893	-1.0	1000.0	10.0	PercentPerSecond	0.01	Configuration	REAL
2.2.6.6	DC-link Voltage Ref. Filter Tc	2894	0.0	1.0	0.05	s	0.01	Configuration	REAL
2.2.6.7	DC-link Voltage Ref. Float Filter Tc	2895	0.0	1.0	0.05	s	0.01	Configuration	REAL
2.2.6.8	DC-link Voltage Ref. Mode	2888	0	65535	0		1	Configuration	UINT

6.3.2.7 DC-link Current Reference

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.2.7.1	DC-link Current Ref. Source	6138	0	2	0		1	Configuration	UINT
2.2.7.2	DC-link Current Ref.	6136	-300.0	300.0	0.0	%	0.01	Configuration	REAL
2.2.7.3	DC-link Current Ramp Rate	6135	-1.0	1000.0	100.0	PercentPerSecond	0.01	Configuration	REAL
2.2.7.4	DC-link Current Ramp Reset	6137	0	3	0		1	Configuration	UINT
2.2.7.5	DC-link Current Ref. Filter Tc	6140	0.001	1.0	0.05	s	0.001	Configuration	REAL

2.2.7.6	DC-link Current Ref. Analog Input	6142	0	29999	0		1	Configuration	UINT
2.2.7.7	DC-link Current Ref. Analog Max.	6143	-300.0	300.0	100.0	%	0.01	Configuration	REAL
2.2.7.8	DC-link Current Ref. Analog Min.	6144	-300.0	300.0	-100.0	%	0.01	Configuration	REAL
2.2.7.9	DC-Link Current Droop Curve U	5302	0.0	200.0	[100,100,100,100]	%	0.01	Configuration	REAL
2.2.7.10	DC-link Current Droop Curve I	5301	-300.0	300.0	[0,0,0,0]	%	0.01	Configuration	REAL
2.2.7.11	DC-Link Current Droop Curve G	5300	0.0	100.0	[0,0,0,0]		0.01	Configuration	REAL

6.3.2.8 DC-link Power Reference

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.2.8.1	DC-link Power Ref. Source	7890	0	2	0		1	Configuration	UINT
2.2.8.2	DC-link Power Ref.	7689	-300.0	300.0	0.0	%	0.01	Configuration	REAL
2.2.8.3	DC-link Power Ramp Rate	7691	-1.0	1000.0	100.0	PercentPerSecond	0.01	Configuration	REAL
2.2.8.4	DC-link Power Ramp Reset	7692	0	3	0		1	Configuration	UINT
2.2.8.5	DC-link Power Ref. Analog Input	7694	0	29999	0		1	Configuration	UINT
2.2.8.6	DC-link Power Ref. Analog Max.	7695	-300.0	300.0	100.0	%	0.01	Configuration	REAL
2.2.8.7	DC-link Power Ref. Analog Min.	7696	-300.0	300.0	-100.0	%	0.01	Configuration	REAL

6.3.3 Limits

6.3.3.1 Grid Current Limit

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.3.1.1	Enable Freq. Based Current Limit	2343	0	1	1		1	Configuration	BOOL
2.3.1.2	Current Limit Priority	2853	0	1	0		1	Configuration	UINT
2.3.1.3	Neg. Active Current Limit Source	2854	0	2	0		1	Configuration	UINT
2.3.1.4	Neg. Active Current Limit	2855	-300.0	0.0	-300.0	%	0.1	Configuration	REAL
2.3.1.5	Neg. Active Current Limit Ramp Up Rate	2856	0.0	1000.0	100.0	PercentPerSecond	0.1	Configuration	REAL
2.3.1.6	Pos. Active Current Limit Source	2857	0	2	0		1	Configuration	UINT
2.3.1.7	Pos. Active Current Limit	2858	0.0	300.0	300.0	%	0.01	Configuration	REAL
2.3.1.8	Current Limit Source	2852	0	1	0		1	Configuration	UINT
2.3.1.9	Current Limit	2851	0.0	1000.0	300.0	%	0.01	Configuration	REAL
2.3.1.10	Active Current Limit Pos. Analog Input	6576	0	29999	0		1	Configuration	UINT
2.3.1.11	Active Current Limit Pos. Analog Input Min.	6575	0.0	300.0	0.0	%	1	Configuration	REAL
2.3.1.12	Active Current Limit Pos. Analog Input Max.	6574	0.0	300.0	300.0	%	1	Configuration	REAL
2.3.1.13	Active Current Limit Neg. Analog Input	6577	-3.4e+38	29999.0	0.0		1	Configuration	REAL
2.3.1.14	Active Current Limit Neg. Analog Input Min.	6579	-300.0	0.0	-300.0		1	Configuration	REAL
2.3.1.15	Active Current Limit Neg. Analog Input Max.	6578	-300.0	0.0	0.0		1	Configuration	REAL

6.3.3.2 Grid Power Limit

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.3.2.1	Neg. Active Power Limit Source	2861	0	2	0		1	Configuration	UINT
2.3.2.2	Neg. Active Power Limit	2862	-300.0	0.0	-300.0	%	0.1	Configuration	REAL
2.3.2.3	Neg. Active Power Limit Ramp Up Rate	2863	0.0	1000.0	100.0	PercentPerSecond	0.1	Configuration	REAL
2.3.2.4	Pos. Active Power Limit Source	2864	0	2	0		1	Configuration	UINT
2.3.2.5	Pos. Active Power Limit	2865	0.0	300.0	300.0	%	0.01	Configuration	REAL
2.3.2.6	Active Power Limit Neg. Analog Input	6580	0	29999	0		1	Configuration	UINT
2.3.2.7	Active Power Limit Neg. Analog Input Min	6582	-300.0	0.0	-300.0		1	Configuration	REAL

2.3.2.8	Active Power Limit Neg. Analog Input Max.	6581	-300.0	0.0	0.0		1	Configuration	REAL
2.3.2.9	Active Power Limit Pos. Analog Input	6583	-3.4e+38	29999.0	0.0		1	Configuration	REAL
2.3.2.10	Active Power Limit Pos. Analog Input Min.	6585	0.0	300.0	0.0		1	Configuration	REAL
2.3.2.11	Active Power Limit Pos. Analog Input Max.	6584	0.0	300.0	300.0		1	Configuration	REAL

6.3.3.3 Short Term Current Injection

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.3.3.1	Short Term Current Enabled	2873	0	1	1		1	Configuration	BOOL
2.3.3.2	Short Term Current Limit	2866	0.0	1000.0	140.0	%	0.01	Configuration	REAL
2.3.3.3	Short Term Current Time	2867	0.0	10.0	3.0	s	0.001	Configuration	REAL
2.3.3.4	Short Term Current Mode	2917	0	2	0		1	Configuration	UINT
2.3.3.5	Short Term Current Switching Freq.	5097	-3.4e+38	3.4e+38	6000.0	Hz	0.01	Configuration	REAL

6.3.3.4 DC Link Voltage Limiters

6.3.3.4.1 Undervoltage Limit Controller

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.3.4.1.1	Undervoltage Control	1809	0	1	1		1	Configuration	BOOL
2.3.4.1.2	Undervoltage Limit Source	2900	0	1	0		1	Configuration	UINT
2.3.4.1.3	Undervoltage Limit	2901	0.0	320.0	70.0	%	0.01	Configuration	REAL

6.3.3.4.2 Overvoltage Limit Controller

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.3.4.2.1	Overvoltage Control	1802	0	1	1		1	Configuration	BOOL
2.3.4.2.2	Overvoltage Limit Source	2897	0	1	0		1	Configuration	UINT
2.3.4.2.3	Overvoltage Limit	2898	0.0	320.0	120.0	%	0.01	Configuration	REAL

6.3.4 Digital and Analog Inputs

6.3.4.1 Digital Inputs

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.4.1.1	Run Enable Input	103	0	29999	1		1	Configuration	UINT
2.4.1.2	External Event 1 Input	4557	0	29999	0		1	Configuration	UINT
2.4.1.3	External Event 2 Input	4560	0	29999	0		1	Configuration	UINT
2.4.1.4	Cooling Monitor Input	2400	0	29999	1		1	Configuration	UINT
2.4.1.5	Force I/O Control Input	4513	0	29999	0		1	Configuration	UINT
2.4.1.6	Force FB Control Input	4511	0	29999	0		1	Configuration	UINT
2.4.1.7	I/O Start Input	200	0	29999	0		1	Configuration	UINT
2.4.1.8	I/O Stop Input	201	0	29999	1		1	Configuration	UINT
2.4.1.9	I/O Reset Input	203	0	29999	0		1	Configuration	UINT
2.4.1.10	Switch On Enable Input	4728	0	29999	10114		1	Configuration	UINT
2.4.1.11	Pre Charge Request Inp.	6567	0	29999	10115		1	Configuration	UINT
2.4.1.12	MCB Close Enable Input	6557	0	29999	1		1	Configuration	UINT
2.4.1.13	MCB Feedback Close Input	6552	0	29999	10116		1	Configuration	UINT
2.4.1.14	MCB Feedback Open Input	6553	0	29999	0		1	Configuration	UINT
2.4.1.15	MCB Tripped Input	6554	0	29999	0		1	Configuration	UINT
2.4.1.16	Freq. Reset Input	5055	0	29999	0		1	Configuration	UINT
2.4.1.17	Freq. Decrease. Input	5054	0	29999	0		1	Configuration	UINT
2.4.1.18	Freq. Increase. Input	5053	0	29999	0		1	Configuration	UINT
2.4.1.19	Voltage Reset Input	5071	0	29999	0		1	Configuration	UINT
2.4.1.20	Voltage Decr. Input	5070	0	29999	0		1	Configuration	UINT
2.4.1.21	Voltage Incr. Input	5069	0	29999	0		1	Configuration	UINT
2.4.1.22	Quick Stop Input	212	0	29999	1		1	Configuration	UINT
2.4.1.23	Quick Stop Input 2	5104	0	29999	1		1	Configuration	UINT

6.3.4.2 Analog Inputs

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.4.2.1	Active Current Ref. Analog Input	6571	0	29999	0		1	Configuration	UINT
2.4.2.2	Active Current Limit Neg. Analog Input	6577	-3.4e+38	29999.0	0.0		1	Configuration	REAL
2.4.2.3	Active Current Limit Pos. Analog Input	6576	0	29999	0		1	Configuration	UINT
2.4.2.4	Active Power Limit Neg. Analog Input	6580	0	29999	0		1	Configuration	UINT
2.4.2.5	Active Power Limit Pos. Analog Input	6583	-3.4e+38	29999.0	0.0		1	Configuration	REAL
2.4.2.6	Active Power Ref. Analog Input.	6593	0	29999	0		1	Configuration	UINT
2.4.2.7	DC-link Current Ref. Analog Input	6142	0	29999	0		1	Configuration	UINT
2.4.2.8	DC-link Power Ref. Analog Input	7694	0	29999	0		1	Configuration	UINT

6.3.5 Digital and Analog Outputs

6.3.5.1 Digital Outputs

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.5.1.1	Ready Output	205	0	29999	0		1	Configuration	UINT
2.5.1.2	Run Output	206	0	29999	0		1	Configuration	UINT
2.5.1.3	Static Fault Output	208	0	29999	0		1	Configuration	UINT
2.5.1.4	Static Warning Output	209	0	29999	0		1	Configuration	UINT
2.5.1.5	Toggling Fault Output	5180	0	29999	0		1	Configuration	UINT
2.5.1.6	Toggling Warning Output	5181	0	29999	0		1	Configuration	UINT
2.5.1.7	FB CTW Bit 12 Output	5193	0	29999	0		1	Configuration	UINT
2.5.1.8	FB CTW Bit 13 Output	5194	0	29999	0		1	Configuration	UINT
2.5.1.9	FB CTW Bit 14 Output	5198	0	29999	0		1	Configuration	UINT
2.5.1.10	FB CTW Bit 15 Output	5191	0	29999	0		1	Configuration	UINT
2.5.1.11	DC-link Voltage Superv. Output	5157	0	29999	0		1	Configuration	UINT
2.5.1.12	DC-link Voltage Superv. Limit	5158	0.0	1500.0	100.0	V	0.01	Configuration	REAL
2.5.1.13	Local Control Active Output	5178	0	29999	0		1	Configuration	UINT
2.5.1.14	I/O Control Active Output	5177	0	29999	0		1	Configuration	UINT
2.5.1.15	Fieldbus Control Active Output	5197	0	29999	0		1	Configuration	UINT
2.5.1.16	Active Exception 1 Output	5189	0	29999	0		1	Configuration	UINT
2.5.1.17	Event 1 Number	5188	0	65535	0		1	Configuration	UINT
2.5.1.18	Active Event 2 Output	5190	0	29999	0		1	Configuration	UINT
2.5.1.19	Event 2 Number	5290	0	65535	0		1	Configuration	UINT
2.5.1.20	Limit Supervision 1 Output	5254	0	29999	0		1	Configuration	UINT
2.5.1.21	No Warning Output	217	0	29999	0		1	Configuration	UINT
2.5.1.22	No Fault Output	218	0	29999	0		1	Configuration	UINT
2.5.1.23	Local Control Forcing Requested Output	125	0	29999	0		1	Configuration	UINT
2.5.1.24	I/O Forcing Requested Output	121	0	29999	0		1	Configuration	UINT
2.5.1.25	FB Forcing Requested Output	120	0	29999	0		1	Configuration	UINT
2.5.1.26	Pre-Charge Request Output	6563	0	29999	10102		1	Configuration	UINT
2.5.1.27	Pre-charge Allowed Output	6569	0	29999	0		1	Configuration	UINT
2.5.1.28	MCB Close Output	6551	0	29999	10105		1	Configuration	UINT
2.5.1.29	MCB Close Pulse Output	6555	0	29999	0		1	Configuration	UINT
2.5.1.30	MCB Open Pulse Output	6556	0	29999	0		1	Configuration	UINT

6.3.5.2 Delayed Digital Outputs

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.5.2.1	Delayed Output 1 Content Sel.	8032	0	14	0		1	Configuration	UINT
2.5.2.2	Delayed Output 1 On Delay	8036	0.0	320.0	0.0	s	0.01	Configuration	REAL
2.5.2.3	Delayed Output 1 Off Delay	8038	0.0	320.0	0.0	s	0.01	Configuration	REAL
2.5.2.4	Delayed Output 1 Output	8040	0	29999	0		1	Configuration	UINT
2.5.2.5	Delayed Output 2 Content Sel.	8033	0	14	0		1	Configuration	UINT
2.5.2.6	Delayed Output 2 On Delay	8037	0.0	320.0	0.0	s	0.01	Configuration	REAL
2.5.2.7	Delayed Output 2 Off Delay	8039	0.0	320.0	0.0	s	0.01	Configuration	REAL

2.5.2.8	Delayed Output 2 Output	8041	0	29999	0		1	Configuration	UINT

6.3.5.3 Analog Outputs

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.5.3.1	Active Current Output	2450	0	29999	0		1	Configuration	UINT
2.5.3.2	Absolute Active Current Output	2451	0	29999	0		1	Configuration	UINT
2.5.3.3	Reactive Current Output	2452	0	29999	0		1	Configuration	UINT
2.5.3.4	Output Current Output	2453	0	29999	0		1	Configuration	UINT
2.5.3.5	Power Factor Output	2457	0	29999	0		1	Configuration	UINT
2.5.3.6	Absolute Active Power Output	2456	0	29999	0		1	Configuration	UINT
2.5.3.7	Active Power Output	2455	0	29999	0		1	Configuration	UINT
2.5.3.8	Active Power Output Max.	2458	-10000.0	10000.0	3000.0	kW	0.01	Configuration	REAL
2.5.3.9	Active Power Output Min.	2459	-10000.0	10000.0	-3000.0	kW	0.01	Configuration	REAL
2.5.3.10	DC-link Voltage Output	2454	0	29999	0		1	Configuration	UINT
2.5.3.11	DC-link Voltage Output Max.	2460	50.0	150.0	120.0	%	1	Configuration	REAL
2.5.3.12	DC-link Voltage Output Min.	2461	0.0	100.0	0.0	%	1	Configuration	REAL
2.5.3.13	Main Fan Speed Output	2462	0	29999	0		1	Configuration	UINT
2.5.3.14	Main Fan Speed Output Max.	2463	0.0	10000.0	10000.0	rpm	1	Configuration	REAL
2.5.3.15	Main Fan Speed Output Min.	2464	0.0	10000.0	0.0	rpm	1	Configuration	REAL
2.5.3.16	DC-link Current Output	2465	0	29999	0		1	Configuration	UINT
2.5.3.17	DC-link Current Output Max.	2466	0.0	300.0	100.0	%	1	Configuration	REAL
2.5.3.18	DC-link Current Output Min.	2467	-300.0	0.0	-100.0	%	1	Configuration	REAL

6.3.6 Start and Stop Settings

6.3.6.1 Start Settings

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.6.1.1	Start Delay	4718	0.0	10.0	0.0	s	0.1	Configuration	REAL
2.6.1.2	Run Enable Input	103	0	29999	1		1	Configuration	UINT
2.6.1.3	Switch On Enable Input	4728	0	29999	10114		1	Configuration	UINT

6.3.6.2 Quick Stop

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.6.2.1	Quick Stop Input	212	0	29999	1		1	Configuration	UINT
2.6.2.2	Quick Stop Input 2	5104	0	29999	1		1	Configuration	UINT
2.6.2.3	Quick Stop Response	4587	0	11	10		1	Configuration	UINT

6.3.6.3 Pre Charge

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.6.3.1	Pre-Charge Request Output	6563	0	29999	10102		1	Configuration	UINT
2.6.3.2	Pre-Charge Ready Level	6566	60.0	120.0	80.0	%	0.01	Configuration	REAL
2.6.3.3	Pre Charge Request Inp.	6567	0	29999	10115		1	Configuration	UINT
2.6.3.4	Pre-charge Allowed Output	6569	0	29999	0		1	Configuration	UINT
2.6.3.5	Pre-Charge Allowed Level	5510	30.0	3.4e+38	50.0	%	1	Configuration	REAL

6.3.6.4 Main Circuit Breaker

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.6.4.1	MCB Close Output	6551	0	29999	10105		1	Configuration	UINT
2.6.4.2	MCB Feedback Close Input	6552	0	29999	10116		1	Configuration	UINT
2.6.4.3	MCB Feedback Open Input	6553	0	29999	0		1	Configuration	UINT
2.6.4.4	MCB Tripped Input	6554	0	29999	0		1	Configuration	UINT
2.6.4.5	MCB Close Pulse Output	6555	0	29999	0		1	Configuration	UINT
2.6.4.6	MCB Open Pulse Output	6556	0	29999	0		1	Configuration	UINT
2.6.4.7	MCB Close Enable Input	6557	0	29999	1		1	Configuration	UINT
2.6.4.8	MCB Feedback Fault Delay	6558	0.0	5.0	2.0	s	0.01	Configuration	REAL

2.6.4.9	MCB Closing Mode	6559	0	3	0		1	Configuration	UINT
2.6.4.10	MCB Opening Mode	6560	0	3	0		1	Configuration	UINT

6.3.6.5 LCL-Filter Energization

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.6.5.1	Filter Voltage Ramp Time	5161	0.0	10000.0	0.1	s	0.01	Configuration	REAL
2.6.5.2	Max. Filter Energization Time	5162	0.1	50.0	10.0	s	0.1	Configuration	REAL

6.3.7 Control Places

6.3.7.1 Control Place Settings

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.7.1.1	Control Place Selection	114	1	3	3		1	Configuration	UINT
2.7.1.2	Force FB Control Input	4511	0	29999	0		1	Configuration	UINT
2.7.1.3	Force I/O Control Input	4513	0	29999	0		1	Configuration	UINT
2.7.1.4	Control Place Forcing Mode	1972	0	3	0		1	Configuration	UINT
2.7.1.5	Control Place Independent Reset	109	0	1	0		1	Configuration	BOOL
2.7.1.6	Control Place Release Mode	4800	0	1	1		1	Configuration	BOOL
2.7.1.7	Control Place Forcing Priority	4732	1	3	[1,3,2]		1	Configuration	UINT

6.3.7.2 Local Control

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.7.2.1	Local Control Mode	107	0	2	0		1	Configuration	UINT
2.7.2.2	Continue Operation in Local Control	108	0	1	0		1	Configuration	BOOL

6.3.7.3 I/O Control

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.7.3.1	I/O Start Input	200	0	29999	0		1	Configuration	UINT
2.7.3.2	I/O Stop Input	201	0	29999	1		1	Configuration	UINT
2.7.3.3	I/O Reset Input	203	0	29999	0		1	Configuration	UINT
2.7.3.4	I/O Start Mode	213	0	2	0		1	Configuration	UINT
2.7.3.5	Continue Operation in I/O Control	5111	0	1	0		1	Configuration	BOOL

6.3.7.4 Fieldbus Control

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.7.4.1	Continue Operation in Fieldbus Control	5112	0	1	0		1	Configuration	BOOL
2.7.4.2	Fieldbus Start Mode	5114	0	1	1		1	Configuration	UINT

6.3.8 Converter Control

6.3.8.1 Modulation

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.8.1.1	Switching Frequency	2920	-16777216.0	16777216.0	1000.0	kHz	0.01	Configuration	REAL
2.8.1.2	Modulator Options	5093	0x0	0xffff	0x0		1	Configuration	WORD
2.8.1.3	Modulator Type	5100	1	6	1		1	Configuration	UDINT
2.8.1.4	Forward Voltage Compensation	6518	0.0	1000.0	100.0	%	0.01	Configuration	REAL

6.3.8.2 Advanced Grid Control

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.8.2.1	Active Current Kp	2868	0.0	1000.0	100.0	%	0.01	Configuration	REAL

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.8.2.2	Active Current Ti	2869	0.0	1000.0	100.0	%	0.01	Configuration	REAL
2.8.2.3	Grid PLL Tc	9659	0.01	1.0	0.1	s	0.01	Configuration	REAL
2.8.2.4	Active Damping Kp	2871	0.0	10000.0	100.0	%	0.01	Configuration	REAL
2.8.2.5	Reactive Current Kp	2849	0.001	1000.0	100.0	%	0.01	Configuration	REAL
2.8.2.6	Reactive Current Ti	2850	0.0	1000.0	100.0	%	0.01	Configuration	REAL
2.8.2.7	Grid Control Options	9658	0x0	0xffff	0x0		1	Configuration	WORD
2.8.2.8	Paralleling Sync. Run Kp	9655	0.0	1000.0	0.1		0.01	Configuration	REAL
2.8.2.9	Paralleling Sync. Stop Kp	9656	0.0	1000.0	0.4		0.01	Configuration	REAL
2.8.2.10	Paralleling Sync. Shift Kp	9657	0.0	1000.0	100.0	%	0.01	Configuration	REAL
2.8.2.11	Power Factor Sign Mode	5098	0	1	0		1	Configuration	UINT
2.8.2.12	Ac Voltage Control Kp	6510	0.0	1000.0	100.0	%	0.01	Configuration	REAL
2.8.2.13	Ac Voltage Control Ti	6511	0.0	1000.0	100.0	%	0.01	Configuration	REAL
2.8.2.14	PQ Mode Active Current Ctrl. Kp	6512	0.0	10000.0	7.0	Hz	0.01	Configuration	REAL
2.8.2.15	PQ Mode Active Current Ctrl. Ti	6513	0.0	100.0	0.02	s	0.01	Configuration	REAL
2.8.2.16	PQ Mode Reactive Current Ctrl Ki	6514	0.0	10000.0	400.0	%	0.01	Configuration	REAL
2.8.2.17	Virtual Impedance	6515	0.0	100.0	20.0	%	0.01	Configuration	REAL
2.8.2.18	Virtual Impedance Tc	6516	0.0	1.0	0.05	s	0.001	Configuration	REAL
2.8.2.19	Virtual Impedance Filt. Tc	6517	0.0	1.0	0.001	s	0.001	Configuration	REAL
2.8.2.20	Harmonic Current Control Gain	6519	0.0	1000.0	0.0	%	0.01	Configuration	REAL
2.8.2.21	Short Term Current Options	2918	0x0	0xffff	0x1		1	Configuration	WORD
2.8.2.22	Neg. Seq. Current Control Kp	6500	0.0	1000.0	100.0	%	0.01	Configuration	REAL
2.8.2.23	Neg. Seq. Current Control Ti	6501	0.0	10000.0	100.0	%	0.01	Configuration	REAL
2.8.2.24	Neg. Seq. Voltage Control Kp	6502	0.0	1000.0	100.0	%	0.01	Configuration	REAL
2.8.2.25	Neg. Seq. Voltage Control Ti	6503	0.0	10000.0	100.0	%	0.01	Configuration	REAL
2.8.2.26	Harmonic Voltage Control Gain	4999	0.00	1000.0	100.0	%	0.01	Configuration	REAL

6.3.8.3 Advanced DC-link Control

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.8.3.1	DC-link Voltage Ctrl. Kp	2902	0.0	1000.0	100.0	%	0.1	Configuration	REAL
2.8.3.2	DC-link Voltage Ctrl. Ti	2903	0.0	1000.0	100.0	%	0.01	Configuration	REAL
2.8.3.3	DC-link Voltage Ctrl. Td	2907	0.0	1000.0	100.0	%	0.01	Configuration	REAL
2.8.3.4	DC-link Voltage Droop. Tc	5095	0.0	1.0	0.05	s	0.01	Configuration	REAL
2.8.3.8	Overvoltage Control Kp	1803	0.0	10000.0	100.0	%	0.01	Configuration	REAL
2.8.3.9	Overvoltage Control Ti	1804	0.0	10000.0	100.0	%	0.01	Configuration	REAL
2.8.3.10	Overvoltage Control Td	1805	0.0	10000.0	100.0	%	0.01	Configuration	REAL
2.8.3.11	Undervoltage Control Kp	1806	0.001	10000.0	100.0	%	0.01	Configuration	REAL
2.8.3.12	Undervoltage Control Ti	1807	0.0	10000.0	100.0	%	0.01	Configuration	REAL
2.8.3.13	Undervoltage Control Td	1808	0.0	10000.0	100.0	%	0.01	Configuration	REAL

6.3.9 Protections and Responses

6.3.9.1 General Settings

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.9.1.1	Retry after Fault	2927	0	1	1		1	Configuration	BOOL
2.9.1.2	Active Current Limit Warn. Preset	5131	0.0	300.0	0.0	%	0.01	Configuration	REAL
2.9.1.3	Active Current Limit Warn. Ramp Rate	5130	-1.0	10000.0	100.0	PercentPerSecond	0.001	Configuration	REAL

6.3.9.2 Misc. Responses

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.9.2.1	DC-link Voltage Ripple Response	2929	0	2	1		1	Configuration	UDINT
2.9.2.2	LCL Fan Fail Response	2941	0	11	10		1	Configuration	UINT

6.3.9.3 External Event

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.9.3.1	External Event 1 Input	4557	0	29999	0		1	Configuration	UINT
2.9.3.2	External Event 1 Response	4559	0	11	10		1	Configuration	UINT
2.9.3.3	External Event 2 Input	4560	0	29999	0		1	Configuration	UINT
2.9.3.4	External Event 2 Response	4562	0	11	10		1	Configuration	UINT

6.3.9.4 Cooling Monitor

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.9.4.1	Cooling Monitor Input	2400	0	29999	1		1	Configuration	UINT
2.9.4.2	Cooling Monitor Fault Delay	2401	0.0	300.0	10.0	s	0.01	Configuration	REAL
2.9.4.3	Cooling Monitor Response	2402	0	3	0		1	Configuration	UINT

6.3.9.5 Measured Temp. Protection

6.3.9.5.1 Temp. 1 Protection

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.9.5.1.1	Temp. 1 Input	5206	0	29999	0		1	Configuration	UINT
2.9.5.1.2	Temp. 1 Limit 1	5207	-300.0	300.0	120.0	°C	0.01	Configuration	REAL
2.9.5.1.3	Temp. 1 Limit 2	5208	-300.0	300.0	150.0	°C	0.01	Configuration	REAL
2.9.5.1.4	Temp. 1 Limit 2 Response	5209	3	11	11		1	Configuration	UINT

6.3.9.5.2 Temp. 2 Protection

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.9.5.2.1	Temp. 2 Input	5210	0	29999	0		1	Configuration	UINT
2.9.5.2.2	Temp. 2 Limit 1	5211	-300.0	300.0	120.0	°C	0.01	Configuration	REAL
2.9.5.2.3	Temp. 2 Limit 2	5212	-300.0	300.0	150.0	°C	0.01	Configuration	REAL
2.9.5.2.4	Temp. 2 Limit 2 Response	5213	3	11	11		1	Configuration	UINT

6.3.9.5.3 Temp. 3 Protection

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.9.5.3.1	Temp. 3 Input	5214	0	29999	0		1	Configuration	UINT
2.9.5.3.2	Temp. 3 Limit 1	5215	-300.0	300.0	120.0	°C	0.01	Configuration	REAL
2.9.5.3.3	Temp. 3 Limit 2	5216	-300.0	300.0	150.0	°C	0.01	Configuration	REAL
2.9.5.3.4	Temp. 3 Limit 2 Response	5217	3	11	11		1	Configuration	UINT

6.3.9.5.4 Temp. 4 Protection

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.9.5.4.1	Temp. 4 Input	5218	0	29999	0		1	Configuration	UINT
2.9.5.4.2	Temp. 4 Limit 1	5219	-300.0	300.0	120.0	°C	0.01	Configuration	REAL
2.9.5.4.3	Temp. 4 Limit 2	5220	-300.0	300.0	150.0	°C	0.01	Configuration	REAL
2.9.5.4.4	Temp. 4 Limit 2 Response	5221	3	11	11		1	Configuration	UINT

6.3.9.5.5 Temp. 5 Protection

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.9.5.5.1	Temp. 5 Input	5222	0	29999	0		1	Configuration	UINT
2.9.5.5.2	Temp. 5 Limit 1	5223	-300.0	300.0	120.0	°C	0.01	Configuration	REAL
2.9.5.5.3	Temp. 5 Limit 2	5224	-300.0	300.0	150.0	°C	0.01	Configuration	REAL
2.9.5.5.4	Temp. 5 Limit 2 Response	5225	3	11	11		1	Configuration	UINT

6.3.9.5.6 Temp. 6 Protection

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.9.5.6.1	Temp. 6 Input	5226	0	29999	0		1	Configuration	UINT
2.9.5.6.2	Temp. 6 Limit 1	5227	-300.0	300.0	120.0	°C	0.01	Configuration	REAL

2.9.5.6.3	Temp. 6 Limit 2	5228	-300.0	300.0	150.0	°C	0.01	Configuration	REAL
2.9.5.6.4	Temp. 6 Limit 2 Response	5229	3	11	11		1	Configuration	UINT

6.3.9.5.7 Temp. 7 Protection

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.9.5.7.1	Temp. 7 Input	5239	0	29999	0		1	Configuration	UINT
2.9.5.7.2	Temp. 7 Limit 1	5243	-300.0	300.0	120.0	°C	1	Configuration	REAL
2.9.5.7.3	Temp. 7 Limit 2	5269	-300.0	300.0	150.0	°C	1	Configuration	REAL
2.9.5.7.4	Temp. 7 Limit 2 Response	5235	3	11	11		1	Configuration	UINT

6.3.9.5.8 Temp. 8 Protection

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.9.5.8.1	Temp. 8 Input	5240	0	29999	0		1	Configuration	UINT
2.9.5.8.2	Temp. 8 Limit 1	5247	-300.0	300.0	120.0	°C	1	Configuration	REAL
2.9.5.8.3	Temp. 8 Limit 2	5270	-300.0	300.0	150.0	°C	1	Configuration	REAL
2.9.5.8.4	Temp. 8 Limit 2 Response	5236	3	11	11		1	Configuration	UINT

6.3.9.5.9 Temp. 9 Protection

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.9.5.9.1	Temp. 9 Input	5241	0	29999	0		1	Configuration	UINT
2.9.5.9.2	Temp. 9 Limit 1	5249	-300.0	300.0	120.0	°C	1	Configuration	REAL
2.9.5.9.3	Temp. 9 Limit 2	5271	-300.0	300.0	150.0	°C	1	Configuration	REAL
2.9.5.9.4	Temp. 9 Limit 2 Response	5237	3	11	11		1	Configuration	UINT

6.3.9.5.10 Temp. 10 Protection

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.9.5.10.1	Temp. 10 Input	5242	0	29999	0		1	Configuration	UINT
2.9.5.10.2	Temp. 10 Limit 1	5268	-300.0	300.0	120.0	°C	1	Configuration	REAL
2.9.5.10.3	Temp. 10 Limit 2	5272	-300.0	300.0	150.0	°C	1	Configuration	REAL
2.9.5.10.4	Temp. 10 Limit 2 Response	5238	3	11	11		1	Configuration	UINT

6.3.9.5.11 Common

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.9.5.11.1	Meas. Valid Range	5230	-300.0	300.0	[200,-50]	°C	0.01	Configuration	REAL
2.9.5.11.2	Meas. Out of Range Response	5231	0	11	3		1	Configuration	UINT

6.3.9.6 Thermistor Monitoring

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.9.6.1	Thermistor Monitoring Response	5232	0	11	10		1	Configuration	UINT
2.9.6.2	Thermistor Monitor 1 Input	1520	0	29999	0		1	Configuration	UINT
2.9.6.3	Thermistor Monitor 2 Input	1522	0	29999	0		1	Configuration	UINT
2.9.6.4	Thermistor Monitor 3 Input	1524	0	29999	0		1	Configuration	UINT

6.3.9.7 Live Zero

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.9.7.1	Live Zero Response	4554	0	13	3		1	Configuration	UINT

6.3.9.8 Fieldbus Protections

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.9.8.1	Fieldbus Fault Response	1304	0	13	10		1	Configuration	UINT
2.9.8.2	No Fieldbus Connection Response	1305	0	13	0		1	Configuration	UINT
2.9.8.3	Process Data Timeout Response	1306	1	13	1		1	Configuration	UINT
2.9.8.4	Process Data Timeout Delay	1340	50.0	3.4e+38	1000.0	s	0.01	Configuration	REAL
2.9.8.5	Fieldbus Watchdog Response	5244	0	13	3		1	Configuration	UINT
2.9.8.6	Fieldbus Watchdog Delay	5245	0.0	3000.0	5.0	s	0.01	Configuration	REAL
2.9.8.7	Fieldbus Watchdog Start Delay	5246	0.0	3000.0	30.0	s	0.01	Configuration	REAL

6.3.9.9 HMI Connection Loss

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.9.9.1	HMI Connection Loss	5420	0	11	10		1	Configuration	UINT

6.3.9.10 Cooling Fan Supervision

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.9.10.1	Main Fan Fail Response	2939	0	11	3		1	Configuration	UINT
2.9.10.2	Internal Fan Fail Response	2940	0	11	3		1	Configuration	UINT

6.3.9.11 Limit Supervision

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.9.11.1	Limit Supervision 1 Sel.	1990	0	3	0		1	Configuration	UINT
2.9.11.2	Limit Supervision 1 Type	5252	0	2	0		1	Configuration	USINT
2.9.11.3	Limit Supervision 1 Threshold	5253	-300.0	350.0	0.0	%	0.1	Configuration	REAL
2.9.11.4	Limit Supervision 1 Enable	4098	0	3	0		1	Configuration	UINT

6.3.9.12 Grid Frequency Supervision

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.9.12.1	High Freq. Instant Fault Limit	2840	0.0	590.0	66.0	Hz	0.1	Configuration	REAL
2.9.12.2	High Freq. Delayed Fault Limit	255	0.0	100.0	64.0	Hz	0.01	Configuration	REAL
2.9.12.3	High Freq. Warning Limit	257	0.0	100.0	62.0	Hz	0.01	Configuration	REAL
2.9.12.4	Low Freq. Warning Limit	259	0.0	50.0	48.0	Hz	0.01	Configuration	REAL
2.9.12.5	Low Freq. Delayed Fault Limit	258	0.0	50.0	46.5	Hz	0.01	Configuration	REAL
2.9.12.6	Low Freq. Instant Fault Limit	2841	0.0	590.0	45.0	Hz	0.1	Configuration	REAL
2.9.12.7	Freq. Supervision Hysteresis	256	0.0	5.0	0.5	Hz	0.01	Configuration	REAL
2.9.12.8	High Freq. Fault Delay	260	0.0	10.0	0.2	s	0.01	Configuration	REAL
2.9.12.9	Low Freq. Fault Delay	261	0.0	10.0	0.2	s	0.01	Configuration	REAL

6.3.9.13 Grid Voltage Supervision

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.9.13.1	Grid Overvoltage Instant Fault Limit	2842	-1000.0	1000.0	115.0	%	0.1	Configuration	REAL
2.9.13.2	Grid Overvoltage Delayed Fault Limit	250	0.0	150.0	110.0	%	0.01	Configuration	REAL
2.9.13.3	Grid Overvoltage Warning Limit	252	0.0	150.0	105.0	%	0.01	Configuration	REAL
2.9.13.4	Grid Undervoltage Warning Limit	253	0.0	150.0	90.0	%	0.01	Configuration	REAL
2.9.13.5	Grid Undervoltage Delayed Fault Limit	262	0.0	150.0	85.0	%	0.01	Configuration	REAL
2.9.13.6	Grid Undervoltage Instant Fault Limit	2843	-1000.0	1000.0	80.0	%	0.1	Configuration	REAL
2.9.13.7	Grid Volt. Supervision Hysteresis	251	0.0	10.0	1.0	%	0.01	Configuration	REAL
2.9.13.8	Grid Overvoltage Fault Delay	254	0.0	10.0	0.5	s	0.01	Configuration	REAL
2.9.13.9	Grid Undervoltage Fault Delay	263	0.0	10.0	0.5	s	0.01	Configuration	REAL

6.3.9.14 Missing Grid Phase

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.9.14.1	Phase Fault Limit Run	266	0.0	100.0	10.0	%	0.01	Configuration	REAL
2.9.14.2	Phase Fault Limit Stop	264	0.0	100.0	60.0	%	0.01	Configuration	REAL
2.9.14.3	Phase Fault Delay	265	0.0	100.0	0.1	s	0.01	Configuration	REAL

6.3.9.15 Pre Charge Monitoring

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.9.15.1	Max. Pre-Charge Time	6564	0.0	50.0	20.0	s	0.01	Configuration	REAL
2.9.15.2	Min. Pre-Charge Time	6565	0.0	5.0	0.5	s	0.01	Configuration	REAL
2.9.15.3	Ext. Pre-Charge Monitor Response	6568	0	11	0		1	Configuration	UINT

6.3.10 External Grid Synchronization

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
2.10.1	Ext. Grid Synchronize Input	6595	0	29999	0		1	Configuration	UINT
2.10.2	Ext. Grid Connect Enable Input	6598	0	29999	1		1	Configuration	UINT
2.10.3	Ext. Grid Connect Input	6596	0	29999	0		1	Configuration	UINT

2.10.4	Ext. Grid Connected Feedback Input	6597	0	29999	0		1	Configuration	UINT
2.10.5	Ext. Grid Synchronized Output	6599	0	29999	0		1	Configuration	UINT
2.10.6	Ext. Grid Connect Output	6600	0	29999	0		1	Configuration	UINT
2.10.7	Ext. Grid Connected Feedback Delay	6604	0.0	10.0	2.0		1	Configuration	REAL
2.10.8	Ext. Grid Connected Response	6602	-32768	2	1		1	Configuration	INT
2.10.9	Ext. Grid Control Mode	6603	-32768	6	4		1	Configuration	INT
2.10.10	Ext. Grid Voltage Feedback Source	6605	0	2	0		1	Configuration	UINT

6.4 Maintenance & Service

6.4.1 Software Information

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
3.1.1	Application Version	151					1	Configuration	STRING

6.4.2 Events

6.4.2.1 Event Simulation

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
3.2.3.1	Simulate Event	1400	0	10	0		1	Configuration	UINT
3.2.3.2	Simulate Persisting Event	1401	0	10	0		1	Configuration	UINT
3.2.3.3	Simulate Event Number	1402	0	65535	5260		1	Configuration	UINT

6.4.3 Operational Counters

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
3.3.1	Control Unit On Time	2000	0	4294967295	0	h	1	Configuration	UDINT
3.3.2	Power Unit On Time	2001	0	4294967295	0	h	1	Configuration	UDINT
3.3.3	Energy Consumption	2002	-	-	-	kWh	1	Configuration	ULINT
3.3.4	Ground Faults	2004	0	50000	0		1	Configuration	UINT
3.3.5	Overvoltage Faults	2005	0	50000	0		1	Configuration	UINT
3.3.6	Overcurrent Faults	2006	0	50000	0		1	Configuration	UINT
3.3.7	Short Circuit Faults	2007	0	50000	0		1	Configuration	UINT
3.3.8	Number of Starts	2008	0	4294967295	0		1	Configuration	UDINT
3.3.9	Active Running Hours	2009	0	4294967295	0	h	1	Configuration	UDINT
3.3.10	Flash 0 Wear Counter	2100	0	4294967295	0		1	Configuration	UDINT
3.3.11	Flash 1 Wear Counter	2101	0	4294967295	0		1	Configuration	UDINT

6.5 Customization

6.5.1 Basic Settings

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
5.1.1	Date and Time	2800	-	-	-		1	Configuration	DATE_AND_TIME
5.1.2	Time Mode	6232			1			Configuration	USINT
5.1.3	NTP Server 1	6233						Configuration	STRING
5.1.4	NTP Server 2	6234						Configuration	STRING

6.5.2 Control Panel

6.5.2.1 Readout Screen 1

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
5.2.1.1	Readout Field 1.1	300	0	4294967295	0		1	Configuration	UDINT
5.2.1.2	Readout Field 1.2	301	0	4294967295	0		1	Configuration	UDINT
5.2.1.3	Readout Field 1.3	302	0	4294967295	0		1	Configuration	UDINT
5.2.1.4	Readout Field 1.4	303	0	4294967295	0		1	Configuration	UDINT

5.2.1.5	Readout Field 1.5	304	0	4294967295	0		1	Configuration	UDINT

6.5.2.2 Readout Screen 2

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
5.2.2.1	Readout Field 2.1	310	0	4294967295	9044		1	Process	UDINT
5.2.2.2	Readout Field 2.2	311	0	4294967295	9040		1	Configuration	UDINT
5.2.2.3	Readout Field 2.3	312	0	4294967295	9041		1	Configuration	UDINT
5.2.2.4	Readout Field 2.4	313	0	4294967295	2950		1	Configuration	UDINT
5.2.2.5	Readout Field 2.5	314	0	4294967295	2952		1	Configuration	UDINT

6.5.3 Custom Status Word

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
5.3.1	Custom Status Word B0	2411	0	65535	100		1	Configuration	UINT
5.3.2	Custom Status Word B1	2412	0	65535	101		1	Configuration	UINT
5.3.3	Custom Status Word B2	2413	0	65535	102		1	Configuration	UINT
5.3.4	Custom Status Word B3	2414	0	65535	103		1	Configuration	UINT
5.3.5	Custom Status Word B4	2415	0	65535	104		1	Configuration	UINT
5.3.6	Custom Status Word B5	2416	0	65535	301		1	Configuration	UINT
5.3.7	Custom Status Word B6	2417	0	65535	302		1	Configuration	UINT
5.3.8	Custom Status Word B7	2418	0	65535	310		1	Configuration	UINT
5.3.9	Custom Status Word B8	2419	0	65535	0		1	Configuration	UINT
5.3.10	Custom Status Word B9	2420	0	65535	0		1	Configuration	UINT
5.3.11	Custom Status Word B10	2421	0	65535	0		1	Configuration	UINT
5.3.12	Custom Status Word B11	2422	0	65535	0		1	Configuration	UINT
5.3.13	Custom Status Word B12	2423	0	65535	0		1	Configuration	UINT
5.3.14	Custom Status Word B13	2424	0	65535	0		1	Configuration	UINT
5.3.15	Custom Status Word B14	2425	0	65535	0		1	Configuration	UINT
5.3.16	Custom Status Word B15	2426	0	65535	0		1	Configuration	UINT

6.6 Option Board Settings

6.6.1 I/O and Relay

6.6.1.1 I/O and Relay Status

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
9.3.1	Digital Input Bit Word	1614	0x0	0xffff	0x0		1	Process	WORD
9.3.2	Digital Output Bit Word	1615	0x0	0xffff	0x0		1	Process	WORD
9.3.3	T31 Analog Output Value	1613	-20.0	20.0	0.0		0.01	Process	REAL
9.3.4	T33 Analog Input Value	1611	-20.0	20.0	0.0		0.01	Process	REAL
9.3.5	T34 Analog Input Value	1612	-20.0	20.0	0.0		0.01	Process	REAL

6.6.1.2 Digital Inputs/Outputs

6.6.1.2.1 Input T13

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
9.4.1.1	T13 Terminal Mode	2015	0	3	0		1	Config	UINT
9.4.1.2	T13 Signal Inversion	2291	0	1	0		1	Config	UINT
9.4.1.3	T13 Standard Debounce Filtering Time	2024	0.0	0.1	0.0	ms	1	Config	REAL

6.6.1.2.2 Input T14

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
9.4.2.1	T14 Terminal Mode	2016	0	3	0		1	Config	UINT
9.4.2.2	T14 Signal Inversion	2292	0	1	0		1	Config	UINT
9.4.2.3	T14 Standard Debounce Filtering Time	2029	0.0	0.1	0.0	ms	1	Config	REAL

6.6.1.2.3 Input T15

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
9.4.3.1	T15 Terminal Mode	2022	0	3	0		1	Config	UINT
9.4.3.2	T15 Signal Inversion	2295	0	1	0		1	Config	UINT
9.4.3.3	T15 Standard Debounce Filtering Time	2297	0.0	0.1	0.0	ms	1	Config	REAL

6.6.1.2.4 Input T16

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
9.4.4.1	T16 Terminal Mode	2298	0	3	0		1	Config	UINT
9.4.4.2	T16 Signal Inversion	2296	0	1	0		1	Config	UINT
9.4.4.3	T16 Standard Debounce Filtering Time	2260	0.0	0.1	0.0	ms	1	Config	REAL

6.6.1.2.5 Input T17

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
9.4.5.1	T17 Terminal Mode	2017	0	3	0		1	Config	UINT
9.4.5.2	T17 Signal Inversion	2293	0	1	0		1	Config	UINT
9.4.5.3	T17 Standard Debounce Filtering Time	2034	0.0	0.1	0.0	ms	1	Config	REAL

6.6.1.2.6 Input T18

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
9.4.6.1	T18 Terminal Mode	2018	0	3	0		1	Config	UINT
9.4.6.2	T18 Signal Inversion	2294	0	1	0		1	Config	UINT
9.4.6.3	T18 Standard Debounce Filtering Time	2039	0.0	0.1	0.0	ms	1	Config	REAL

6.6.1.2.7 Output T21

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
9.4.7.1	T21 Terminal Mode	4015	0	1	0		1	Config	UINT
9.4.7.2	T21 Digital Output Type	4013	0	3	3		1	Config	UINT

6.6.1.2.8 Output T22

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
9.4.8.1	T22 Terminal Mode	4016	0	1	0		1	Config	UINT
9.4.8.2	T22 Digital Output Type	4014	0	3	3		1	Config	UINT

6.6.1.3 6.6.1.3 Analog Inputs/Outputs

6.6.1.3.1 Output T31

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
9.5.1.1	T31 Terminal Mode	2019	0	5	0		1	Config	UINT
9.5.1.2	T31 Terminal Type	2284	0	2	1		1	Config	UINT
9.5.1.3	T31 Minimum Value	2283	-20.0	20.0	0.0		0.01	Config	REAL
9.5.1.4	T31 Maximum Value	2282	-20.0	20.0	10.0		0.01	Config	REAL

6.6.1.3.2 Input T33

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
9.5.2.1	T33 Terminal Mode	2020	0	6	0		1	Config	UINT
9.5.2.2	T33 Terminal Type	2273	1	2	1		0.01	Config	UINT
9.5.2.3	T33 Minimum Value	2272	-20.0	20.0	0.0		0.01	Config	REAL
9.5.2.4	T33 Maximum Value	2271	-20.0	20.0	10.0		0.01	Config	REAL
9.5.2.5	T33 Filter Time	2270	0.0	60.0	0.0	ms	1	Config	REAL
9.5.2.6	T33 Live Zero Threshold Value	2274	-20.0	20.0	-10.0		0.01	Config	REAL
9.5.2.7	T33 Live Zero Timeout Value	2275	0.0	60.0	0.0	s	0.01	Config	REAL

6.6.2 Temperature Measurement

6.6.2.1 Temperature Measurement Status

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
9.3.2	T4 Temperature Value	4040	-1000.0	1000.0	0.0	°C	1	Process	REAL
9.3.3	T8 Temperature Value	4041	-1000.0	1000.0	0.0	°C	1	Process	REAL
9.3.4	T12 Temperature Value	4042	-1000.0	1000.0	0.0	°C	1	Process	REAL
9.3.5	T16 Temperature Value	4043	-1000.0	1000.0	0.0	°C	1	Process	REAL

9.3.6	T20 Temperature Value	4044	-1000.0	1000.0	0.0	°C	1	Process	REAL

6.6.2.2 Temperature Inputs

6.6.2.2.1 Input T4

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
9.4.1.1	T4 Terminal Mode	4045	0	7	0		1	Config	UINT
9.4.1.2	T4 Connection Type	4046	0	4	0		1	Config	UINT
9.4.1.3	T4 Temperature Sensor Type	4047	0	19	0		1	Config	UINT
9.4.1.4	T4 Offset	4048	-50.0	50.0	0.0	°C	1	Config	REAL

6.6.2.2.2 Input T8

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
9.4.2.1	T8 Terminal Mode	4049	0	7	0		1	Config	UINT
9.4.2.2	T8 Connection Type	4050	0	4	0		1	Config	UINT
9.4.2.3	T8 Temperature Sensor Type	4051	0	19	0		1	Config	UINT
9.4.2.4	T8 Offset	4052	-50.0	50.0	0.0	°C	1	Config	REAL

6.6.2.2.3 Input T 12

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
9.4.3.1	T12 Terminal Mode	4053	0	7	0		1	Config	UINT
9.4.3.2	T12 Connection Type	4054	0	4	0		1	Config	UINT
9.4.3.3	T12 Temperature Sensor Type	4055	0	19	0		1	Config	UINT
9.4.3.4	T12 Offset	4056	-50.0	50.0	0.0	°C	1	Config	REAL

6.6.2.2.4 Input T16

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
9.4.4.1	T16 Terminal Mode	2298	0	7	0		1	Config	UINT
9.4.4.2	T16 Connection Type	4058	0	4	0		1	Config	UINT
9.4.4.3	T16 Temperature Sensor Type	4059	0	19	0		1	Config	UINT
9.4.4.4	T16 Offset	4060	-50.0	50.0	0.0	°C	1	Config	REAL

6.6.2.2.5 Input T20

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
9.4.5.1	T20 Terminal Mode	4017	0	7	0		1	Config	UINT
9.4.5.2	T20 Connection Type	4062	0	4	0		1	Config	UINT
9.4.5.3	T20 Temperature Sensor Type	4063	0	19	0		1	Config	UINT
9.4.5.4	T20 Offset	4064	-50.0	50.0	0.0	°C	1	Config	REAL

6.6.3 Voltage Measurement

6.6.3.1 Voltage Measurement Status

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
9.3.1	X52 Voltage	4086	0.0	10000.0	0.0	V	0.1	Process	REAL
9.3.2	X52 Frequency	4087	-400.0	400.0	0.0	Hz	0.01	Process	REAL
9.3.3	X52 Phase Diff.	4088	-180.0	180.0	0.0	°	1	Process	REAL
9.3.4	X52 Voltage L1	4082	-10000.0	10000.0	0.0	V	0.1	Process	REAL
9.3.5	X52 Voltage L3	4083	-10000.0	10000.0	0.0	V	0.1	Process	REAL
9.3.6	X53 Voltage	4089	0.0	10000.0	0.0	V	0.1	Process	REAL
9.3.7	X53 Frequency	4090	-400.0	400.0	0.0	Hz	0.01	Process	REAL
9.3.8	X53 Phase Diff.	4091	-180.0	180.0	0.0	°	1	Process	REAL

9.3.9	X53 Voltage L1	4084	-10000.0	10000.0	0.0	V	0.1	Process	REAL
9.3.10	X53 Voltage L3	4085	-10000.0	10000.0	0.0	V	0.1	Process	REAL

6.6.3.2 Voltage Input X52

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
9.4.1	X52 Terminal Mode	4099	0	2	0		1	Configuration	UINT
9.4.2	X52 Terminal Voltage Range	4100	1.0	3.4e+38	1.0	V	0.1	Configuration	REAL
9.4.3	X52 Meas. Transformer Grid-Side Voltage	4101	1.0	1e+05	1.0	V	0.1	Configuration	REAL
9.4.4	X52 Meas. Transformer Converter-Side Voltage	4102	1.0	1000.0	1.0	V	0.1	Configuration	REAL
9.4.5	X52 Meas. Transformer Phase Shift	4103	-180.0	180.0	0.0	°	1	Configuration	REAL

6.6.3.3 Voltage Input X53

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
9.5.1	X53 Terminal Mode	4104	0	2	0		1	Configuration	UINT
9.5.2	X53 Terminal Voltage Range	4105	1.0	3.4e+38	1.0	V	0.1	Configuration	REAL
9.5.3	X53 Meas. Transformer Grid-Side Voltage	4106	1.0	1e+05	1.0	V	0.1	Configuration	REAL
9.5.4	X53 Meas. Transformer Converter-Side Voltage	4107	1.0	1000.0	1.0	V	0.1	Configuration	REAL
9.5.5	X53 Meas. Transformer Phase Shift	4108	-180.0	180.0	0.0	°	1	Configuration	REAL

6.7 Connectivity

6.7.1 Integrated Communication

6.7.2 Communication Interfaces

6.7.2.1 Host Settings

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
10.2.1.1	Fully Qualified Domain Name	7036	-	-	-		1	Configuration	STRING

6.7.2.2 Ethernet Interface X0

6.7.2.2.1 IPv4 Settings

This is a menu screen for enabling IP configuration of the X0 interface. Check the available settings via the control panel or MyDrive® Insight.

6.7.2.2.2 IPv4 Status

This is a menu screen containing information about the IP configuration of the X0 interface. Check the available information via the control panel or MyDrive® Insight.

6.7.2.2.3 Ethernet Interface X1/X2 Settings

6.7.2.2.3.1 IPv4 Settings

This is a menu screen for enabling IP configuration of the X1/X2 interface. Check the available settings via the control panel or MyDrive® Insight.

6.7.2.2.3.2 IPv4 Status

This is a menu screen containing information about the IP configuration of the X1/X2 interface. Check the available information via the control panel or MyDrive® Insight.

6.7.2.2.4 Ethernet port X0

6.7.2.2.4.1 X0 Settings

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
10.1.1.4.1.1	Link configuration X0	7047	0	4	0		1	Config	USINT

6.7.2.2.5 Ethernet port X1

6.7.2.2.5.1 X1 Settings

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
10.1.1.5.1.1	Link Configuration X1	7048	0	4	0		1	Config	USINT

6.7.2.2.6 Ethernet port X2

6.7.2.2.6.1 X2 Settings

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
10.1.1.6.1.1	Link Configuration X2	7049	0	4	0		1	Config	USINT

6.7.2.2.7 Port Mirroring

This is a menu screen for enabling and disabling the port-mirroring function for network troubleshooting with a network analyzer tool. Check the available configurations via the control panel or MyDrive® Insight.

6.7.2.3 Protocols

6.7.2.3.1 PROFINET®

6.7.2.3.1.1 Status

6.7.2.3.1.1.1 PROFINET® Report

This is the PROFINET® report screen showing active PROFINET® connection and configuration information. Check the available information via the control panel or MyDrive® Insight.

6.7.2.3.1.2 Configuration

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
10.1.2.1.2.1	Name of Station	7080	-	-	-		1	Config	STRING

6.7.2.3.1.3 Diagnosis

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
10.1.2.1.3.1	Diagnostic Fault	7081	0	1	1		1	Config	BOOL
10.1.2.1.3.2	Diagnostic Warning	7083	0	1	1		1	Config	BOOL

6.7.2.3.2 Modbus® TCP

6.7.2.3.2.1 Configuration

Index	Name	Number	Min	Max	Default	Unit	Reso	Handling Type	Data type
10.1.2.2.1.1	Persistent Storage	7061	0	1	0		1	Config	BOOL
10.1.2.2.1.2	Byte Order	7062	0	1	0		1	Config	USINT
10.1.2.2.1.3	Word Order	7063	0	1	1		1	Config	USINT

7 Parameter Descriptions

7.1 How to read Parameter Descriptions

The following chapters contain descriptions for all the parameters in the Grid Converter application software. Each chapter represents a single subgroup within the menu structure.

First the group is described. After that all parameters all listed and described. If applicable, the parameter selections are listed in the table, containing further descriptions for each selection.

The following is an example of a parameter description:

P1.2.3[1] Parameter Name[2] No. 1234[3]
This is a parameter description.[4]

Number	Name	Description
0[5]	Name of selection 1[6]	Description of selection 1. [7]
1	Name of selection 2	Description of selection 2.

[1]: The index number of the parameter, that is, the menu location.
[2]: Name of the parameter.
[3]: Unique identification number of the parameter.
[4]: Description of the parameter.
[5]: Selection number.
[6]: Selection name.
[7]: Description of the selection.

7.2 Monitoring (Menu Index 1)

7.2.1 Basic Monitoring (Menu Index 1.1)

P 1.1.1 Grid Voltage No. 9040

Shows grid line-to-line voltage (RMS) at point of common coupling.

P 1.1.2 Grid Frequency No. 9041

Shows the actual grid frequency.

P 1.1.3 Grid Power Factor No. 9053

Shows the grid power factor.

P 1.1.4 DC-link Current No. 5115

Shows the actual DC-link current.

P 1.1.5 DC-link Voltage No. 9044

Shows the actual DC-link voltage.

P 1.1.6 DC-link Power No. 5117

Shows the actual DC-link power.

P 1.1.7 Application Status Word 1 No. 6201

Shows the current status of the Application Status Word 1.

Bit No.	Name	Description
0	Ready to Run	0: The converter is not ready to start modulation. Check 'Grid Control Ready Status Word' and 'Application Ready Status Word'. 1: The converter is ready to start modulation
1	Run	0: The unit is not running (modulating) 1: The unit is running (modulating)
2	Info active (static)	Static status signal for info events. 0: One or more info level events are active 1: No info level events active.
3	Warning (static)	Static status signal for warning events. 0: No warning level events active. 1: One or more warning level events are active.
4	Fault (static)	Static status signal for fault events. 0: No fault level events active. 1: One or more fault level events are active.
5	PC control	0: PC (MyDrive® Insight) is not the active control place 1: PC (MyDrive® Insight) is the active control place.
6	Panel control	0: Panel control is not the active control place 1: Panel control is the active control place.
7	I/O control	0: I/O control is not the active control place 1: I/O control is the active control place.
8	Fieldbus control	0: I/O control is not the active control place 1: I/O control is the active control place.
9	Reserved	-
10	Reserved	-
11	Run enable	0: The Run Enable Input is not active. Start is prohibited. 1: The Run Enable Input is active allowing the converter to start or maintain running.
12	Start command	0: No start request is active from the active control place. 1: The start request is active from the active control place.
13	Quick stop	0: No quick stop is active from I/O or fieldbus. 1: The quick stop has been activated from I/O or fieldbus.
14	Reserved	-
15	Reserved	-

P 1.1.8 Application Status Word 2 No. 6202

Shows the current status of the Application Status Word 2.

Bit No.	Name	Description
0	Info active (toggled)	Toggled status signal for info events. This signal will toggle down for 1 second, whenever a new info event is activated while another info event was already active.
1	Warning active (toggled)	Toggled status signal for warning events. This signal will toggle down for 1 second, whenever a new warning is activated while another warning was already active.
2	Fault active (toggled)	Toggled status signal for fault events. This signal will toggle down for 1 second, whenever a new fault is activated while another fault was already active.
3	Ready to Start Pre-Charge	Pre-Charge allowed active is a status signal indicating that the DC-link voltage is below the Pre-Charge Allowed Level (No. 5510) and a new start command or Pre-Charge command can successfully start the pre-charging. 1: Pre-charging is allowed. 0: Pre-charging is not allowed.
4	Ready to Close MCB	Ready to Close MCB is a status signal indicating that the DC-link voltage has reached above the Pre-Charge Ready Level (No. 6566) and all the interlocks to close the breaker are active. 1: MCB closing is allowed. 0: MCB closing is not allowed.
5	Pre-Charge Detected	Pre-Charged Detected is a status signal indicating that the DC-link voltage is increasing from 0% towards Pre-Charge Ready Level. 1: Pre-charging is detected. 0: Pre-charging is not detected.
6	Pre-Charge Output	Pre-Charge Output is a status signal indicating that the Pre-Charge relay output is active. 1: Pre-charge relay output is active. 0: Pre-charge relay output is not active.
7	MCB Close Command	MCB Close Command is a status signal indicating that the MCB closing relay output is active. 1: MCB closing relay output is active. 0: MCB closing relay output is not active.
8	MCB Feedback	MCB Feedback is a status signal indicating that the MCB is closed if configured and controlled by the application. 1: MCB is closed. 0: MCB is open.
9	Switch Off Request	Switch Off Request is a status signal indicating that the Switch On Enable Input (No. 4728) is false or the Switch On Enable bit (B0) from the fieldbus is false. 1: Switch off requests from I/O or Fieldbus is active or stop with MCB open requested from control panel or MyDrive Insight. 0: No switch off request from I/O or Fieldbus is active
10	Pre-Charge Ready	Pre-Charge Ready is a status signal indicating that DC-link voltage is above the Pre-Charge Ready Level (No. 6566).

Bit No.	Name	Description
		1: Pre-charging is ready. 0: Pre-charging is not ready.
11	MCB Close Enabled	MCB Close Enabled is a status signal indicating that the MCB closing is enabled from both MCB Close Enable Input (6557) and MCB Close Enable bit from the fieldbus. 1: MCB closing is enabled. 0: MCB closing is not enabled.
12	Ready to Switch On	Ready to Switch On is a status signal indicating that all the application interlocks needed to start the converter are active. 1: Converter is ready to switch on. 0: Converter is not ready to switch on. One of the following interlocks are missing: - Switch On Enable (either from I/O or fieldbus). - MCB close enable (either from I/O or fieldbus). - No Quick stop is active. - No fault is active.
13	Filter Energized	Filter Energized is a status signal indicating that the LCL-filter is energized. 1: Filter is energized. 0: Filter is not energized.
14	Reserved	-
15	Reserved	-

P 1.1.9 Fault Status Word 1 No. 6203

Shows the current status of the Fault Status Word 1.

Bit No.	Name	Description
0	Over current	Rectifier overcurrent, DC-link capacitor overcurrent, output overcurrent or output short circuit has occurred.
1	DC-Link Over voltage	DC-link voltage is above normal operating range.
2	DC-Link Under voltage	DC-link voltage is below normal operating range.
3	Reserved	-
4	Unit under temperature	IGBT, rectifier heatsink, or power unit temperature is below normal operating range.
5	Reserved	-
6	Reserved	-
7	Reserved	-
8	Earth Fault	High-impedance earth leakage current on the inverter terminals.
9	Reserved	-
10	Fieldbus issue	Fieldbus process data timeout, watchdog, loss of fieldbus I/O or connection has occurred.
11	HMI control lost	While in control of the converter, Control Panel or PC tool connection has been lost.
12	Reserved	-
13	Thermistor Fault	One or more thermistor protection functions is active.
14	Auxiliary device	One or more aux-bus connected power component temperatures is above normal operating range.
15	External temperature measurement	One or more temperature measurement protection functions is active.

P 1.1.10 Fault Status Word 2 No. 6204

Shows the current status of the Fault Status Word 2.

Bit No.	Name	Description
0	Analog Input Live Zero	One of the analog inputs live zero fault is active. 0: No live zero fault is active 1: One or more of the analog inputs live zero faults are active
1	Pre charge Failed	Pre-charging has failed. 0: No fault corresponding to the pre-charge failure is active 1: Pre-charge failure fault is active
2	MCB Feedback Fault	MCB feedback fault is active because of the feedback missing. 0: No MCB feedback fault is active 1: MCB feedback fault is active
3	Quick Stop Active	0: No quick stop fault is active 1: One or more of the quick stop faults are active
4	Thermistor Over Temperature	0: No thermistor over temperature faults is active 1: One or more of the thermistors over temperature faults are active
5	MCB Trip	0: No MCB trip fault is active 1: MCB trip input from breaker has triggered the MCB trip fault.
6	External Fault	0: None of the External Event faults are active 1: One or more of the External Event faults are active
7	Cooling Supervision Fault	0: No cooling supervision faults is active 1: Cooling supervision fault is active
8	Fieldbus Watchdog	0: Fieldbus watchdog fault is not active. 1: Fieldbus watchdog fault is active.
9	Line Synchronization Fault	0: Line synchronization fault is not active 1: Line synchronization fault active
10	Short Term Current Injection	0: Short term current injection fault is not active. 1: Short term current injection fault is active
11	Reserved	-
12	Reserved	-
13	Reserved	-
14	Reserved	-
15	Reserved	-

P 1.1.11 Warning Status Word 1 No. 6205

Shows the current status of the Warning Status Word 1.

Bit No.	Name	Description
0	Over current	Rectifier overcurrent, DC-link capacitor overcurrent, output overcurrent or output short circuit has occurred.
1	DC-Link Over voltage	DC-link voltage is above normal operating range.
2	DC-Link Under voltage	DC-link voltage is below normal operating range.
3	Reserved	-
4	Unit under temperature	IGBT, rectifier heatsink, or power unit temperature is below normal operating range.
5	Reserved	-
6	Reserved	-
7	Reserved	-
8	Earth Warning	High-impedance earth leakage current on the inverter terminals.
9	Reserved	-
10	Fieldbus issue	Fieldbus process data timeout, watchdog, loss of fieldbus I/O or connection has occurred.
11	HMI control lost	While in control of the converter, Control Panel or PC tool connection has been lost.
12	Reserved	-
13	Thermistor Warning	One or more thermistor protection functions is active.
14	Auxiliary device	One or more aux-bus connected power component temperatures is above normal operating range.
15	External temperature measurement	One or more temperature measurement protection functions is active.

P 1.1.12 Warning Status Word 2 No. 6206

Shows the current status of the Warning Status Word 2.

Bit No.	Name	Description
0	Analog Input Live Zero	One of the analog inputs live zero warning is active. 0: No live zero warning is active 1: One or more of the analog inputs live zero faults are active
1	Reserved	-
2	Reserved	-
3	Quick Stop Active	0: No quick stop warning is active 1: One or more of the quick stop warnings are active
4	Thermistor Over Temperature	0: No thermistor over temperature Warning is active 1: One or more of the thermistors over temperature warnings are active
5	Reserved	-
6	External Warning	0: None of the External Event warnings are active 1: One or more of the External Event warnings are active
7	Cooling Supervision Warning	0: No cooling supervision warning is active 1: Cooling supervision warning is active
8	Fieldbus Watchdog	0: Fieldbus watchdog warning is not active. 1: Fieldbus watchdog warnings is active.
9	Reserved	-
10	Short Term Current Injection	0: Short term current injection warning is not active. 1: Short term current injection warning is active
11	Reserved	-
12	Reserved	-
13	Reserved	-
14	Reserved	-
15	Reserved	-

P 1.1.13 Last Fault Number No. 1610

Shows the number of the most recent active fault.

P 1.1.14 Last Warning Number No. 1609

Shows the number of the most recent active warning.

P 1.1.15 Grid Control Status Word No. 6540

Shows the current status of the Grid Control Status Word.

Bit No.	Name	Description
0	Converter Control Ready	0: Grid Converter control is not ready. See Grid Control Ready Status Word (No. 5096) 1: Grid Converter control is ready to modulate.
1	Running	0: Grid Converter is not running. 1: Grid Converter is running.
2	Reserved	-
3	Fault Active	0: No fault is active 1: One or more of the quick stop warnings are active
4	Reserved	-
5	Reserved	-
6	DC-link Charged	0: DC-link is not charged. 1: DC-link is charged.
7	LCL-Filter Energization Ready	0: Filter is not energized. 1: Filter is energized.
8	Reserved	-
9	Reserved	-
10	Reserved	-
11	Reserved	-
12	Reserved	-
13	Reserved	-
14	Reserved	-
15	Reserved	-

P 1.1.16 Grid Control Ready Status Word No. 5096

Shows the current status of the Grid Control Ready Status Word.

Bit No.	Name	Description
0	Run Enabled	0: Run Enable is missing 1: Run Enable is active
1	Fault Active	0: One or multiple faults are active 1: No fault is active
2	Pre-Charge Done	0: Pre-charging is not completed 1: Pre-charging is completed
3	DC-link voltage within operating range	0: DC-link voltage is not within the under & over-voltage fault limits 1: DC-link voltage is within the under & over-voltage fault limits
4	Power unit ready	0: Power unit is not ready 1: Power unit is ready
5	Successful phase sync.	0: Error in grid voltage phase locked loop 1: No error in grid voltage phase locked loop
6	Frequency supervision	0: Grid frequency is not within the instantaneous trip limits 1: Grid frequency is within the instantaneous trip limits
7	Grid voltage supervision	0: Grid voltage is not within the instantaneous trip limits 1: Grid voltage is within the instantaneous trip limits
8	Correct voltage measurement option wiring	0: Phase order of the converter terminal voltage and voltage measurement option is different 1: Phase order of the converter terminal voltage and voltage measurement option is same
9	Valid LCL filter values	0: LCL filter data is not correct 1: LCL filter data is correct
10	Valid Configuration	0: DC-link under & over-voltage limits are very close to each other. 1: DC-link under & over-voltage limits are wide enough for operation.
11	Reserved	-
12	Reserved	-
13	Reserved	-
14	Reserved	-
15	Reserved	-

P 1.1.17 Application Ready Status Word No. 6525

Shows the status of the Application Ready Status Word.

Bit No.	Name	Description
0	Switch On Enabled	1: Switch on enable from I/O & fieldbus is active. 0: Switch on enable is missing or stop with MCB open requested from control panel or MyDrive Insight
1	MCB Close Enabled	1: MCB close enable present 0: MCB close enable missing *Not used in DC/DC Converter Application.*
2	MCB Ready	1: MCB closed or anyway not preventing modulation 0: Modulation prevented due the MCB not being closed *Not used in DC/DC Converter Application.*
3	Quick Stop Inverse	1: Quick Stop not active 0: Quick Stop active
4	Reserved	-
5	Reserved	-
6	Reserved	-
7	Reserved	-
8	Reserved	-
9	Reserved	-
10	Reserved	-
11	Reserved	-
12	Reserved	-
13	Reserved	-
14	Reserved	-
15	Reserved	-

P 1.1.18 Limit Control Status Word No. 9077

Shows the status of the Limit Control Status Word.

Bit No.	Name	Description
0	Pos. Active Current Limit	0: Positive Active Current Limiter not active (not limiting) 1: Positive Active Current Limiter active (limiting)
1	Neg. Active Current Limit	0: Negative Active Current Limiter not active (not limiting) 1: Negative Active Current Limiter active (limiting)
2	Short Term Current Injection Limit	0: Short Term Current Injection Limiter not active (not limitng) 1: Short Term Current Injection Limiter active (limiting)
3	Reserved	
4	DC-link Overvoltage control	0: DC-link overvoltage controller is not active (not regualting) 1: DC-link overvoltage controller is active (regualting)
5	DC-link Undervoltage control	0: DC-link undervoltage controller is not active (not regualting) 1: DC-link undervoltage controller is active (regualting)
6	Pos. Active Power Limit	0: Pos. Active Power Limiter is not active (not limiting) 1: Pos. Active Power Limiter is active (limiting)
7	Neg. Active Power Limit	0: Neg. Active Power Limiter is not active (not limiting) 1: Neg. Active Power Limiter is active (limiting)
8	Pos. Reactive Current Limit	0: Pos. Reactive Current Limiter is not active (not limiting) 1: Pos. Reactive Current Limiter is active (limiting)
9	Neg. Reactive Current Limit	0: Neg. Reactive Current Limiter is not active (not limiting) 1: Neg. Reactive Current Limiter is active (limiting)
10	Reserved	-
11	Reserved	-
12	Reserved	-
13	Reserved	-
14	Reserved	-
15	Reserved	-

P 1.1.19 DC-link Nominal Current No. 5120

Shows the DC-link nominal current. The readout is calculated based on other nominal parameters:

$$DC-link\ Nominal\ Current = sqrt(3) * \frac{Grid\ Nominal\ Voltage * Grid\ Nominal\ Current}{DC-link\ Nominal\ Voltage}$$

P 1.1.20 Grid Nominal Current Converter-Side No. 6505

Shows Grid nominal current reduced to the converter side of the main transformer.

P 1.1.21 Grid Nominal Voltage Converter-Side No. 6504

Shows grid nominal voltage reduced to the converter side of the main transformer.

P 1.1.22 Grid Nominal Power No. 5119

Shows the grid nominal power. The readout is calculated based on nominal parameters.

$$Grid\ Nominal\ Power = sqrt(3) * Grid\ Nominal\ Voltage * Grid\ Nominal\ Current$$

P 1.1.23 Ext. Grid Status Word No. 6594

Shows the status for grid synchronization.

Bit No.	Name	Description
0	Grid Detected	1: Grid voltage feedback is available 0: No Grid voltage feedback is available
1	Phase Locked Loop operation (PLL)	1: Phase locked loop is running
2	Synchronization in progress	1: Synchronization is ongoing 0: No Synchronization is ongoing
3	Voltage Synched	1: Voltage synchronization is ready
4	Angle Synched	1: Phase angles synchronization is ready
5	Phase Locked Loop Synched (PLL)	1: Phase locked loop is synched
6	Frequency in range	1: Grid frequency is within the instant fault limits 0: Grid frequency is outside the instant fault limits
7	Voltage in range	1: Grid voltage is within the instant fault limits 0: Grid voltage is outside the instant fault limits
8	Reserved	-
9	Reserved	-
10	Reserved	-
11	Reserved	-
12	Reserved	-
13	Reserved	-
14	Reserved	-
15	Reserved	-

7.2.2 Control Mode and Reference Monitoring (Menu Index 1.2)

P 1.2.1 Active Operation Mode No. 170

Shows the active converter operation mode.

Number	Operation Mode
0	Island
1	Droop
2	Droop with base load
3	PQ Control
4	DC Link Voltage (AFE)
5	DC Link Current/Power
6	Active Current/Power

P 1.2.2 Grid Control Mode Selection Status Word No. 9078

Shows the current status of Grid Control Mode Selection Status Word.

Bit No.	Name	Description
0	Island	1: Island Mode is active 0: Island Mode is not active
1	Droop	1: Droop Mode is active 0: Droop Mode is not active
2	Droop with base load	1: Droop with based load Mode is active 0: Droop with base load Mode is not active
3	PQ Control	1: PQ Control Mode is active 0: PQ Control Mode is not active
4	DC Link Voltage (AFE)	1: DC-link Voltage Control Mode is active 0: DC-link Voltage Control Mode is active
5	DC Link Current/Power	1: DC-link Current/Power Control Mode is active 0: DC-link Current/Power Control Mode is active
6	Active Current/Power	1: Active Current/Power Control Mode is active 0: Active Current/Power Control Mode is active
7	Reserved	-
8	Reserved	-
9	Reserved	-
10	Reserved	-
11	Reserved	-
12	Reserved	-
13	Reserved	-
14	Reserved	-
15	Reserved	-

P 1.2.3 Frequency Ref. **No. 1718**

Shows the frequency reference in Hz.

P 1.2.4 Voltage Ref. **No. 6530**

Shows voltage reference in % of grid nominal voltage.

P 1.2.5 Active Current Ref. **No. 2874**

Description: Shows the active current reference in % of nominal grid current in microgrid control when operating in drooping control with base load or in PQ-control.

P 1.2.6 Reactive Current Ref. **No. 2875**

Reactive current reference in % of grid nominal current.

P 1.2.7 Active Power Ref. **No. 2876**

Active power reference in % of nominal grid power microgrid control when operating in drooping control with base load or in PQ-control.

P 1.2.8 Reactive Power Ref. **No. 2877**

Reactive power reference in % of grid nominal power in microgrid control when operating in drooping control with base load or in PQ-control.

P 1.2.9 DC-link Current Ref. Actual **No. 6141**

Actual value of the DC-link current reference in % of the DC-link nominal current.

P 1.2.10 DC-link Voltage Ref. Actual **No. 6543**

Shows the actual DC-link voltage reference. The percentage is calculated according to DC-link Voltage Ref. Mode (No. 2888).

P 1.2.11 DC-link Power Ref. Actual **No. 7693**

Actual value of the DC-link power reference in % of the grid nominal power.

7.2.3 Limit Monitoring (Menu Index 1.3)

P 1.3.1 Limit Control Status Word **No. 9077**

Shows the status of the Limit Control Status Word.

P 1.3.2 Current Limit (Actl.) **No. 2882**

Grid total output current limit in % of the grid nominal current.

P 1.3.3 Neg. Active Current Limit (Actl.) **No. 2878**

Shows the active current limit in negative direction in % of the grid nominal current.

P 1.3.4 Pos. Active Current Limit (Actl.) **No. 2880**

Shows the active current limit in positive direction in % of the grid nominal current.

P 1.3.5 Neg. Active Power Limit (Actl.) **No. 2879**

Description: Shows the active power limit in negative direction in % of the grid nominal power.

P 1.3.6 Pos. Active Power Limit (Actl.) **No. 2881**

Description: Shows the active power limit in positive direction in % of the grid nominal power.

P 1.3.7 Overvoltage Control Limit **No. 6544**

Shows the DC-link overvoltage controller Limit.

P 1.3.8 Undervoltage Control Limit **No. 6546**

Shows the DC-link undervoltage controller limit.

7.2.4 Start and Stop Monitoring (Menu Index 1.4)

P 1.4.1 Pre-Charge Active **No. 6561**

Shows status when pre-charging is active.

P 1.4.2 Pre-Charge Ready **No. 6562**

Shows status when pre-charging is ready.

P 1.4.3 MCB Close Active **No. 171**

Shows status when main circuit breaker close request is active.

P 1.4.4 MCB Feedback **No. 172**

Shows status when Main circuit breaker close feedback is active.

7.2.5 Control Place Monitoring (Menu Index 1.5)

P 1.5.1 Active Control Place **No. 113**

Shows the active control place that controls the converter.

The following are the selections for the parameter.

Number	Active Control Place
0	PC Control (My Drive Insight)
1	Control Panel
2	Fieldbus Control
3	I/O Control

P 1.5.2 FB Forcing Requested **No. 116**

Shows the status of the fieldbus control place forcing request active.

P 1.5.3 I/O Forcing Requested **No. 117**

Shows the status of the I/O-control place forcing request active.

P 1.5.4 Local Control Forcing Requested **No. 124**

Shows the status of the local control place forcing request (made from control panel REM/LOC button).

7.2.6 Converter Output Monitoring (Menu Index 1.6)

P 1.6.1 Converter Output Current **No. 9000**

Shows the converter output current.

P 1.6.2 Converter Output Current % **No. 9001**

Shows the converter output current in % of grid nominal current.

P 1.6.3 Converter Output Voltage **No. 9005**

Shows the converter output voltage.

P 1.6.4 Converter Output Frequency **No. 9015**

Shows converter output frequency.

7.2.7 Grid Monitoring (Menu Index 1.7)

P 1.7.1 Grid Frequency **No. 9041**

Shows the actual grid frequency.

P 1.7.2 Grid Voltage **No. 9040**

Shows grid line-to-line voltage (RMS) at point of common coupling.

P 1.7.3 Grid Voltage Imbalance **No. 9047**

Shows the grid voltage imbalance in % to the nominal grid voltage. A value greater than 3% may indicate grid problems.

P 1.7.4 Grid Current **No. 9060**

Shows the current at the point of common coupling.

P 1.7.5 Grid Current % **No. 9061**

Shows the current at the point of common coupling in % of grid nominal current.

P 1.7.6 Grid Active Current % **No. 9062**

Shows the active current in % of grid nominal current.

P 1.7.7 Grid Reactive Current % **No. 9063**

Shows the reactive current in % of grid nominal current.

P 1.7.8 Grid Active Power **No. 9064**

Shows grid active power.

P 1.7.9 Grid Active Power % **No. 9065**

Shows the grid active power in % of grid nominal power.

P 1.7.10 Grid Reactive Power **No. 9051**

Shows the grid reactive power.

P 1.7.11 Grid Reactive Power % **No. 9052**

Shows the grid reactive power in % of grid nominal power.

P 1.7.12 Grid Power Factor

Shows the grid power factor.

7.2.8 DC-Link Monitoring (Menu Index 1.8)

P 1.8.1 DC-link Voltage **No. 9044**

Shows the actual DC-link voltage.

P 1.8.2 DC-link Voltage % **No. 6542**

Shows the actual DC-link voltage in % of the DC-link nominal voltage.

P 1.8.3 DC-link Current **No. 5115**

Shows the actual DC-link current. The DC-link current is calculated from DC-link Power.

$$DC-link\ Current = \frac{DC-link\ Power}{DC-link\ Voltage}$$

P 1.8.4 DC-link Current % **No. 5116**

Shows the actual DC-link current in % of the DC-link nominal current.

P 1.8.5 DC-link Power **No. 5117**

Shows the actual DC-link power.

P 1.8.6 DC-link Power % **No. 5118**

Shows the actual DC-link power in % of the grid nominal power.

7.2.9 Converter Control Monitoring (Menu Index 1.9)

P 1.9.1 Actual Switching Frequency **No. 2923**

Shows the actual switching frequency.

P 1.9.2 Modulation Index **No. 5101**

Shows the modulation index.

P 1.9.3 Control Unit Temperature **No. 2952**

Shows the temperature of the control unit.

7.2.10 Protection Monitoring (Menu Index 1.10)

7.2.10.1 Measured Temp. Protection Status (Menu Index 1.10.1)

P 1.10.1.1 Protection 1 Temp. **No. 5200**

Shows the temperature measured by the Temperature Measurement board channel configured for Temp. 1 Input (No. 5206) protection.

P 1.10.1.2 Protection 2 Temp. **No. 5201**

Shows the temperature measured by the Temperature Measurement board channel configured for Temp. 2 Input (No. 5210) protection.

P 1.10.1.3 Protection 3 Temp. **No. 5202**

Shows the temperature measured by the Temperature Measurement board channel configured for Temp. 3 Input (No. 5214) protection.

P 1.10.1.4 Protection 4 Temp. **No.5203**

Shows the temperature measured by the Temperature Measurement board channel configured for Temp. 4 Input (No. 5218) protection.

P 1.10.1.5 Protection 5 Temp. **No. 5204**

Shows the temperature measured by the Temperature Measurement board channel configured for Temp. 5 Input (No. 5222) protection.

P 1.10.1.6 Protection 6 Temp. **No. 5205**

Shows the temperature measured by the Temperature Measurement board channel configured for Temp. 6 Input (No. 5226) protection.

P 1.10.1.7 Protection 7 Temp. **No. 5273**

Shows the temperature measured by the Temperature Measurement board channel configured for Temp. 7 Input (No. 5239) protection.

P 1.10.1.8 Protection 8 Temp. **No. 5274**

Shows the temperature measured by the Temperature Measurement board channel configured for Temp. 8 Input (No. 5240) protection.

P 1.10.1.9 Protection 9 Temp. **No. 5275**

Shows the temperature measured by the Temperature Measurement board channel configured for Temp. 9 Input (No. 5241)

protection.

P 1.10.1.10 Protection 10 Temp. No. 5276

Shows the temperature measured by the Temperature Measurement board channel configured for Temp. 9 Input (No. 5242) protection.

7.2.10.2 Supervision Monitoring (Menu Index 1.10.2)

P 1.10.2.1 Grid Supervision Status Word No. 9054

Description: Shows the grid supervision status for Over/Undervoltage & High/Low frequency supervision.

Bit No.	Name	Description
0	Freq. Below Low Delayed Trip Lim.	1: Grid frequency is below the lower delayed fault limit
1	Freq. Below Low Warn. Lim.	1: Grid frequency is below the lower warning limit
2	Freq. Above High Warn. Lim.	1: Grid frequency is above the higher warning limit
3	Freq. Above High Delayed Trip Lim.	1: Grid frequency is above the higher delayed fault limit
4	Freq. Above High Inst. Trip Lim.	1: Grid frequency is above the Instant higher fault limit
5	Freq. Below Low Inst. Trip Lim.	1: Grid frequency is below the Instant lower fault limit
6	Volt. Below Low Delayed Trip Lim.	1: Grid voltage is below the lower delayed fault limit
7	Volt. Below Low Warning Lim.	1: Grid voltage is below the lower warning limit
8	Volt. Above High Warning Lim.	1: Grid voltage is above the higher warning limit
9	Volt. Above High Delayed Trip Lim.	1: Grid voltage is above the higher delayed fault limit
10	Volt. Above High Inst. Trip Lim.	1: Grid voltage is above the Instant higher fault limit
11	Volt. Below Low Inst. Trip Lim.	1: Grid voltage is below the Instant lower fault limit
12	Reserved	-
13	Reserved	-
14	Reserved	-
15	Reserved	-

7.2.11 Custom Status Word Monitoring (Menu Index 1.11)

P 1.11.1 Custom Status Word **No. 2410**

Shows the current status of the Custom Status Word.

7.2.12 Power Unit Monitoring (Menu Index 1.12)

P 1.12.1 Power Capacity **No. 2836**

Shows the power capacity of the drive as percentage. The value is derived from the amount of active power units compared to nominal power unit count of the converter.

P 1.12.2 Unit Nominal Voltage **No. 2830**

Shows the nominal voltage setting as a result of the setting of parameter Unit Voltage Class (No. 2832).

P 1.12.3 Unit Nominal Current **No. 2831**

Shows the nominal current of the unit.

P 1.12.4 Heat Sink Temperature **No. 2950**

Shows the temperature of the power unit heat sink.

7.2.13 Cooling Fan Monitoring (Menu Index 1.13)

P 1.13.1 Main Fan Speed

Shows the speed of the main cooling fan (applicable only for air cooled converters).

P 1.13.2 Internal Fan Speed

Shows the speed of the internal cooling fan (applicable only for air cooled converters).

7.2.14 Fieldbus Process Data Monitoring (Menu Index 1.14)

P 1.14.1 Fieldbus Control Word No. 1335

Description: Shows the Fieldbus Control Word.

Bit	Name	Description	Further information
0	Switch On En- abled	0: Pre-charging(*), closing the main circuit breaker(*), and running are prevented or interrupted. If the main circuit breaker is closed, it is opened(*). 1: Pre-charging(*), closing the main circuit breaker(*), and running are not prevented or interrupted. (*) If controlled by the grid converter unit.	This bit is used with control word bit 3 to enable operation of the unit. When this bit is set to false while running, the unit stops. As shown in the state diagram, to transition from S1 to S2, this bit must be false, otherwise switching on keeps from being inhibited.
1	MCB Close Enabled	0: Closing the main circuit breaker is prevented(*) or the main circuit breaker is opened(*), and running is prevented or interrupted. 1: Closing the main circuit breaker is not prevented(*). (*) If controlled by the grid converter unit.	This bit is used to move from S1 to S2 and allows MCB to close when charging is completed. If the bit is removed anytime during operation, then the unit comes back to S1.
2	Quick Stop	0: Activate Quick Stop. 1: Do not activate Quick Stop.	This bit is used to request a quick stop to be executed. When the bit is set to false during operation, the unit stops modulation, and depending on the configuration an exception is issued.
3	Start	0: Stop the unit if it is running, or stop the startup sequence if it is not completed. 1: Initiate the startup sequence (DC-link pre-charging(*), closing the main circuit breaker(*), and start running), or keep the unit running. (*) If applicable.	A rising edge is required for DC-link pre-charging to start. Depending on parameter number 5114, a rising edge can be required for the unit to start. In that case, if for any reason the unit cannot be started when the rising edge is detected, it will not start until a new rising edge is issued.
4	Pre-charge	0: Stop the DC-link pre-charging, if ongoing. 1: Start or continue the DC-link pre-charging.	This bit is only used when the DC-link precharge is controlled by the application.
5	--	Reserved	
6	--	Reserved	
7	Warning/Fault Reset	0: No action. 1: Reset active warnings/faults.	This bit is used to acknowledge faults in the converter. A rising edge (a transition from false to true) on this bit issues an event reset request.
8	--	Reserved	
9	--	Reserved	
10	Data Valid	0: Ignore the current incoming process data values, instead use the last processed value when the Data Valid bit was true. 1: Use the current incoming process data values.	For Modbus protocol, this bit currently applies to the control word only. For bit 11 ('Watchdog'), the current control word value is used regardless. The default control word value is 0x5. The default value is used as the initial value when the Data Valid bit is false, and whenever the fieldbus watchdog supervision fault is active (event no. 5161 active, when configured as a fault).

11	Watchdog	Incoming watchdog bit from customer.	This is the input used for the fieldbus watchdog.
12	Vendor Specific Bit 1	0: Deactivate vendor specific function using digital input/output virtual slot 6412. 1: Activate vendor specific function using digital input/output virtual slot 6412.	
13	Vendor Specific Bit 2	0: Deactivate vendor specific function using digital input/output virtual slot 6413. 1: Activate vendor specific function using digital input/output virtual slot 6413.	
14	Vendor Specific Bit 3	0: Deactivate vendor specific function using digital input/output virtual slot 6414. 1: Activate vendor specific function using digital input/output virtual slot 6414.	
15	Vendor Specific Bit 4	0: Deactivate vendor specific function using digital input/output virtual slot 6415. 1: Activate vendor specific function using digital input/output virtual slot 6415.	

P 1.14.2 Fieldbus Status Word No. 1307

Description: Shows the current status of the Fieldbus Status Word.

Bit	Name	Description	Further information
0	Ready to Switch On	0: Not ready to switch on 1: Ready to switch on	This bit is true if all following conditions are satisfied: • Switch on enable is present • Quick stop is not requested • No faults are active
1	Ready to Run	0: Converter is not ready to start modulation (Check the ***Grid Control Ready Status*** &***Application Ready Status Word***) 1: Converter is ready to start modulating	All the bits of Grid Control Ready Status as well as the Application Ready Status needs to be high to get the Ready to Run true.
2	Running	0: Converter is not modulating 1: Converter is modulating	
3	Fault	0: No faults are active 1: One or more faults are active	
4	--	Reserved	
5	Quick Stop	0: Quick stop active 1: Quick stop not active	
6	--	Reserved	
7	Warning	0: No warnings active 1: One or more warnings are active	
8	--	Reserved	
9	Control by PLC	0: The active control place is not fieldbus 1: The active control place is fieldbus	
10	--	Reserved	
11	Run Enabled	0: Run enable from the dedicated input signal is missing 1: Run enable from the dedicated input signal is present	
12	--	Reserved	
13	--	Reserved	
14	--	Reserved	
15	Watchdog	Outgoing fieldbus watchdog bit	

P 1.14.3 FB Microgrid Control Word No. 1500

Description: Shows the incoming fieldbus microgrid control word process data value.

Bit	Name	Description
0	Force DC-link Voltage Control Mode	0: Do not force the DC-link Voltage Control (AFE) operating mode. 1: Force the DC-link Voltage Control (AFE) operating mode.
1	Force Island Control Mode	0: Do not force the Island operating mode. 1: Force the Island operating mode.
2	Force Droop Control Mode	0: Do not force the Droop Control operating mode. 1: Force the Droop Control operating mode.
3	Force Droop Control with Base Load Mode	0: Do not force the Droop Control with Base Load operating mode. 1: Force the Droop Control with Base Load operating mode.
4	Force PQ Control Mode	0: Do not force the PQ Control operating mode. 1: Force the PQ Control operating mode.
5	Force DC-link Current/Power Control Mode	0: Do not force the DC-link Current/Power operating mode. 1: Force the DC Current/Power operating mode.
6	Force AC Current/Power Control Mode	0: Do not force the AC Current/Power Control operating mode. 1: Force the AC Current/Power Control operating mode.
7	Increase Frequency Reference	0: Do not increase the grid frequency reference. 1: Increase the grid frequency reference.
8	Decrease Frequency Reference	0: Do not decrease the grid frequency reference. 1: Decrease the grid frequency reference.
9	Frequency Reference Reset	0: Do not reset the grid frequency reference. 1: Reset the grid frequency reference.
10	Increase Voltage Reference	0: Do not increase the grid voltage reference. 1: Increase the grid voltage reference.
11	Decrease Voltage Reference	0: Do not decrease the grid voltage reference. 1: Decrease the grid voltage reference.
12	Voltage Reference Reset	0: Do not reset the grid voltage reference. 1: Reset the grid voltage reference.
13	Frequency Reference Reset Value Selection	0: Reset the grid frequency reference to grid nominal value. 1: Reset the grid frequency reference to grid actual value.
14	Voltage Reference Reset Value Selection	0: Reset the grid voltage reference to grid nominal value. 1: Reset the grid voltage reference to grid actual value.
15	Reserved	

P 1.14.4 FB DC-link Voltage Ref. **No. 6533**

Shows the incoming fieldbus process data DC-link voltage reference. The percentage is calculated according to DC-link Voltage Ref. Mode (No. 2888).

P 1.14.5 FB Overvoltage Limit **No. 4512**

Shows the value of the incoming fieldbus process data for the DC-link overvoltage level in % of the DC-link nominal voltage.

P 1.14.6 FB Undervoltage Limit **No. 4510**

Shows the value of the incoming fieldbus process data for the DC-link undervoltage level in % of the DC-link nominal voltage.

P 1.14.7 FB Active Current Ref. **No. 1501**

Shows the incoming fieldbus process data active current reference in % of the grid nominal current.

P 1.14.8 FB Reactive Current Ref. **No.1502**

Shows the incoming fieldbus process data reactive current reference in % of the grid nominal current.

P 1.14.9 FB Active Power Ref. **No. 1504**

Shows the incoming fieldbus process data active power reference in % of the grid nominal power.

P 1.14.10 FB Reactive Power Ref. **No. 1505**

Shows the incoming fieldbus process data reactive power reference in % of the grid nominal power.

P 1.14.11 FB Freq. Ref. **No. 1506**

Shows the incoming fieldbus frequency reference process data value.

P 1.14.12 FB Voltage Ref. **No. 1508**

Shows the incoming fieldbus process data voltage reference in % of the nominal grid voltage.

P 1.14.13 FB Active Current Limit Neg. **No. 1509**

Shows the incoming fieldbus process data active current limit in negative direction in % of the grid nominal current.

P 1.14.14 FB Active Current Limit Pos. **No. 1510**

Shows the incoming fieldbus process data active current limit in positive direction in % of the grid nominal current.

P 1.14.15 FB Output Current Limit **No. 1511**

Shows the incoming fieldbus process data output current limit in % of the grid nominal current.

P 1.14.16 FB Active Power Limit Neg. **No. 1512**

Shows the incoming fieldbus process data active power limit in negative direction in % of the grid nominal power.

P 1.14.17 FB Active Power Limit Pos. **No. 1513**

Shows the incoming fieldbus process data active power limit in positive direction in % of the grid nominal power.

P 1.14.18 FB DC-link Power Ref. **No. 7690**

Shows the incoming fieldbus process data DC-link power reference in % of the nominal power.

P 1.14.19 FB DC-link Current Ref. **No. 6139**

Shows the fieldbus DC-link current reference in % of the DC-link nominal current.

7.3 Parameters (Menu Index 2)

7.3.1 Basic Parameters (Menu Index 2.1)

NOTICE

It's not recommended to change any of the basic parameters in the run state. In that case, the change request is ignored.

P 2.1.1 Grid Nominal Frequency **No. 6536**

Set the nominal grid voltage frequency for grid control in Hz.

P 2.1.2 Grid Nominal Voltage **No. 6537**

Set the nominal grid voltage for grid control in V. It is automatically updated if Unit Voltage Class (No. 2832) is changed.

P 2.1.3 Grid Nominal Current **No. 6538**

Set the nominal grid current for grid control.

P 2.1.4 Grid Voltage Feedback Source **No. 6539**

Description: Set the grid external voltage measurement configuration. Informs whether grid voltage measurement can be utilized in grid control. This parameter enables the closed loop operation for the Grid Converter as well as to provide readouts for actual Grid Voltage and Grid Frequency.

The following are the selections for the parameter.

Number	Name
0	Off (Grid Converter operates in open loop)
1	X52 (X52 terminal of the voltage measurement is used to operate in closed loop)
2	X53 (X53 terminal of the voltage measurement is used to operate in closed loop)

NOTICE

This function requires that voltage measurement option board (OC7V0) is installed to the converter.

P 2.1.5 Filter Voltage Feedback Source **No. 6541**

Description: Set the filter external voltage measurement configuration. Informs whether filter voltage measurement can be utilized in grid control. This parameter enables the filter & transformer energization feature. The grid converter operates in closed loop operation.

The following are the selections for the parameter.

Number	Name
0	Off (Filter energization is disabled)
1	X52 (X52 terminal of the voltage measurement is used to enable filter energization and operate in closed loop)
2	X53 (X53 terminal of the voltage measurement is used to enable filter energization and operate in closed loop)

Grid Converter can utilize voltage feedback for the line filter (LCL) energization. It can charge the filter capacitors and synchronize to the voltage measured from the other side of the main circuit breaker. This way the inrush currents and voltage transients typically occurring after the breaker closes are effectively avoided.

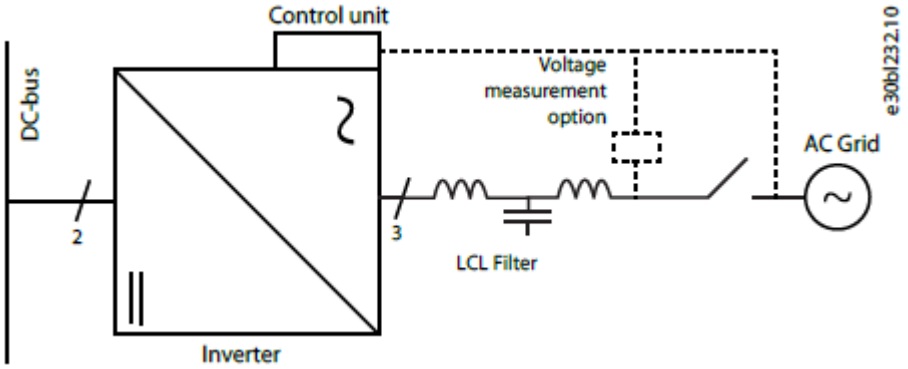


Figure 1. Grid Converter with filter voltage feedback and grid voltage feedback measured by Voltage Measurement option.

NOTICE

This function requires that voltage measurement option board (OC7V0) is installed to the converter.

P 2.1.6 Transformer Grid-Side Voltage **No. 6123**

Nominal voltage of the main transformer grid-side winding.

P 2.1.7 Transformer Converter-Side Voltage **No. 6124**

Nominal voltage of the main transformer converter-side winding.

P 2.1.8 Transformer Phase Shift **No. 6125**

Phase shift of the main transformer, that is, phase difference between the converter and the load voltage.

P 2.1.9 Transformer Nominal Power **No. 6126**

Nominal power of the main transformer.

P 2.1.10 Transformer Nominal Frequency **No. 6127**

Nominal frequency of the main transformer.

P 2.1.11 Transformer Short-Circuit Impedance **No. 6128**

Short-circuit impedance of the main transformer in % of the nominal impedance.

P 2.1.12 Transformer Nom. Load Losses **No. 6129**

Transformer power loss with nominal load.

P 2.1.13 Grid Voltage Feedback Location **No. 6133**

Set the grid voltage feedback location for the closed loop operation. This parameter defines the point which Grid Converter controls in the closed loop operation.

The following are the selections for the parameter.

Number	Name
0	Converter side of the main transformer
1	Grid side of the main transformer.

P 2.1.14 DC-link Nominal Voltage **No. 2834**

Set the DC-link nominal voltage. This parameter is re-initialized based on the unit nominal voltage when set to 0 or if Unit Voltage Class (No. 2832) is changed. This parameter must be set based on the system common dc-bus nominal voltage. This parameter affects the scaling of DC-link voltage reference and readouts as well as DC-link over and undervoltage limit controller references.

P 2.1.15 Unit Voltage Class **No. 2832**

Select the unit voltage class to optimize the performance of the converter. Each power unit is rated for a wide voltage range which the converter can operate in. This parameter is used to specify a narrower band within that range to determine optimized values for the unit's nominal voltage and current. The Grid Nominal Voltage, DC-link nominal voltage, and Over and Undervoltage controller limits are calculated automatically whenever this parameter is changed. This parameter also affects the DC-link ready state which is defined as the minimum value the DC-link voltage needs to reach before the modulation can start.

The following are the selections for the parameter.

Number	Name	Description
1	Low-voltage range	Unit nominal voltage and current are set according to the lowest end of the unit's voltage range. • For example, for B5-units this range is 380-440 V AC and 425-800 V DC. • For example, for 07-units this range is 500-550 V AC and 560-1100 V DC.
2	Mid-voltage range	Unit nominal voltage and current are set according to the middle of the unit's voltage range. • For example, for B5-units this range is 440-480 V AC and 492-800 V DC. • For example, for 07-units this range is 550-600 V AC and 615-1100 V DC.
3	High-voltage range	Unit nominal voltage and current are set according to the highest end of the unit's voltage range. • For example, for B5-units this range is 480-500 V AC and 537-800 V DC. • For example, for 07-units this range is 600-690 V AC and 696-1100 V DC.
4	Wide-voltage range	Unit nominal voltage and current are set according to the unit's whole voltage range. For example, for iC7-Hybrid Liquid Cooled System

Number	Name	Description
		Modules: • For B5 voltage class this range is 380-500 V AC and 350-800 V DC. • For 07 voltage class this range is 500-690 V AC and 350-1100 V DC.

P 2.1.16 Overload Mode **No. 2833**

Select the overload mode. Overloading mode selects an overtemperature protection profile for the converter, affecting current limits and protection activation times. With a higher overloading mode, the converter will operate in a greater degree of overloading before protections take effect. Specific limits and activation delays depend on the conditions.

The following are the selections for the parameter.

Number	Name	Description
0	Automatic	The converter automatically determines whether to use the Low or High Overload Mode.
1	Low overload (LO)	The converter uses the lower overloading profile. Overtemperature protection is activated with a lesser degree of overload.
2	High overload (HO1)	The converter uses a higher overloading profile. Overtemperature protection is activated with a higher degree of overload.
3	High overload increased duty (HO2)	The converter uses the highest overloading profile. Overtemperature protection is activated with the highest degree of overload.

P 2.1.17 Current/Power Positive Direction **No. 2947**

Select the sign convention to be used for current and power. This direction affects both Active and Reactive current/power for grid Converter. For example, if the current/power direction is set as From Grid to DC-Link, then with a reference of -100% for Active current and -100% for Reactive Current, the Active and Reactive current are pushed from the DC-Link side to the Grid side.

The following are the selections for the parameter.

Number	Name	Description
0	From DC-link to Grid	Current and power are positive when flowing from DC-link side to grid side
1	From Grid to DC-link	Current and power are positive when flowing from grid side to DC-link side

P 2.1.18 Paralleling Sync. Mode **No. 2947**

Enable synchronization controller for parallel-connected converters without galvanic isolation to reduce circulating common mode current.

The following are the selections for the parameter.

Number	Name
0	Disabled
1	Enabled.

7.3.2 Control Mode and References (Menu Index 2.2)

7.3.2.1 Control Mode (Menu Index 2.2.1)

P 2.2.1.1 Operation Mode

Select the converter operation mode.

The following are the selections for the parameter.

Number	Name
0	Island
1	Droop
2	Droop with base load
3	PQ Control
4	DC Link Voltage (AFE)
5	DC Link Current/Power
6	Active Current/Power

P 2.2.1.2 Converter Reference Mode

Select between current and power control.

The following are the selections for the parameter.

Number	Name
0	Current Control
1	Power Control

P 2.2.1.3 Harmonic Compensation Mode

Select the voltage harmonic compensation mode.

The following are the selections for the parameter.

Number	Name	Description
0	Off [The feature is disabled]	
1	Voltage Harmonic Compensation (Reduced)	Enables voltage harmonic compensation of 5th, 7th, 11th, and 13th harmonic only.
2	Voltage Harmonic Compensation (Full)	Enables voltage harmonic compensation of 5th, 7th, 11th, 13th, 17th, and 19th harmonic only.

7.3.2.2 Grid Frequency Reference (Menu Index 2.2.2)

Frequency reference is used to control output frequency as well as the active current/power delivered by grid converter. The following is the reference chain diagram of frequency reference.

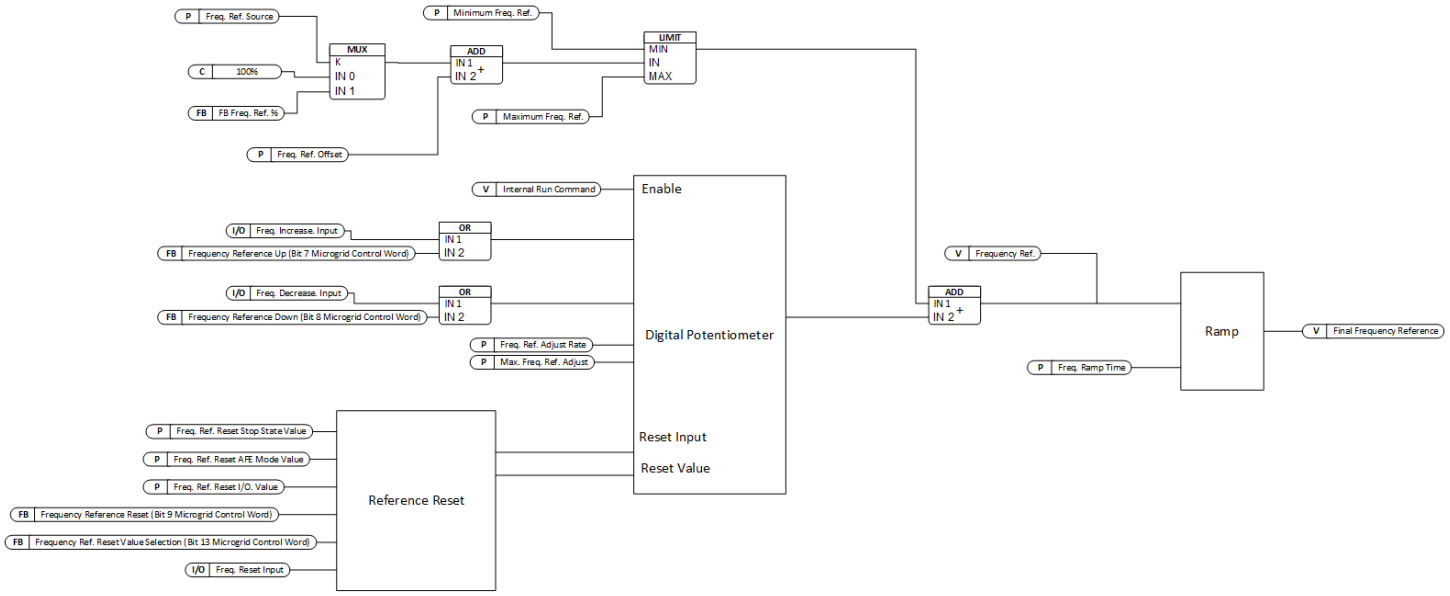


Figure 30: Grid Frequency Reference

P 2.2.2.1 Freq. Ref. Source **No. 5050**

Set the grid frequency reference source.

The following are the selections for the parameter.

Number	Name
0	Grid Nominal Frequency
1	Fieldbus Reference

P 2.2.2.2 Minimum Freq. Ref. **No. 5051**

Set the minimum grid frequency reference in Hz.

P 2.2.2.3 Maximum. Freq. Ref. **No. 5052**

Set the maximum grid frequency reference in Hz.

P 2.2.2.4 Freq. Increase. Input **No. 5053**

Set the digital input for grid frequency reference increase.

P 2.2.2.5 Freq. Decrease. Input **No. 5054**

Set the digital input for grid frequency reference decrease.

P 2.2.2.6 Freq. Reset Input **No. 5055**

Set the digital input for grid frequency reference reset.

P 2.2.2.7 Freq. Ref. Offset **No. 5056**

Set the grid frequency reference offset in Hz.

P 2.2.2.8 Freq. Ref. Adjust Rate **No. 5057**

Set the grid frequency reference adjust rate in Hz per second.

P 2.2.2.9 Max. Freq. Ref. Adjust **No. 5058**

Set the maximum adjustment to the grid frequency reference.

P 2.2.2.10 Freq. Ref. Reset Stop State Value **No. 5059**

Grid frequency reference reset value in stop state.

The following are the selections for the parameter.

Number	Name	Description
0	No Reset	-
1	Reset to Grid Nominal	Reset the reference to grid nominal value at the falling edge of run state (run to stop).
2	Reset to Grid Actual	Reset the reference to grid actual value at the falling edge of run state (run to stop).

P 2.2.2.11 Freq. Ref. Reset I/O. Value **No. 5060**

Grid frequency reference reset value for I/O reset.

The following are the selections for the parameter.

Number	Name	Description
0	No Reset	-
1	Reset to Grid Nominal	Reset the reference to grid nominal value at the rising edge of Freq. Reset Input (No. 5055).
2	Reset to Grid Actual	Reset the reference to grid actual value at the rising edge of Freq. Reset Input (No. 5055).

P 2.2.2.12 Freq.Ref. Reset AFE Mode Value **No. 5061**

Gird frequency reference reset value in AFE mode.

The following are the selections for the parameter.

Number	Name	Description
0	No Reset	-
1	Reset to Grid Nominal	Reset the reference to grid nominal value when the operation mode is changed to any of the Grid Following Mode (for example AFE Mode).
2	Reset to Grid Actual	Reset the reference to grid actual value when the operation mode is changed to any of the Grid Following Mode (for example AFE Mode).

P 2.2.2.13 Freq. Ramp Time **No. 5062**

Ramp rate for grid frequency reference; defined in seconds from 0 to nominal grid frequency. It also applies to the change in reference from the nominal point in the run state. As well as the grid sync. will use this ramp when accelerating / decelerating to get the phase angle correct.

P 2.2.2.14 Freq. Droop Gain **No. 5063**

Set the frequency droop control gain.

P 2.2.2.15 Freq. Droop Tc **No. 5064**

Set the frequency droop control time constant.

P 2.2.2.16 Freq. Drooping Base Load Scale **No. 5065**

Set the base load scale. If the grid is isochronous (non-drooping), the active current will match the reference. If grid is drooping, it is possible to account for the drooping by adjusting the base load scale.

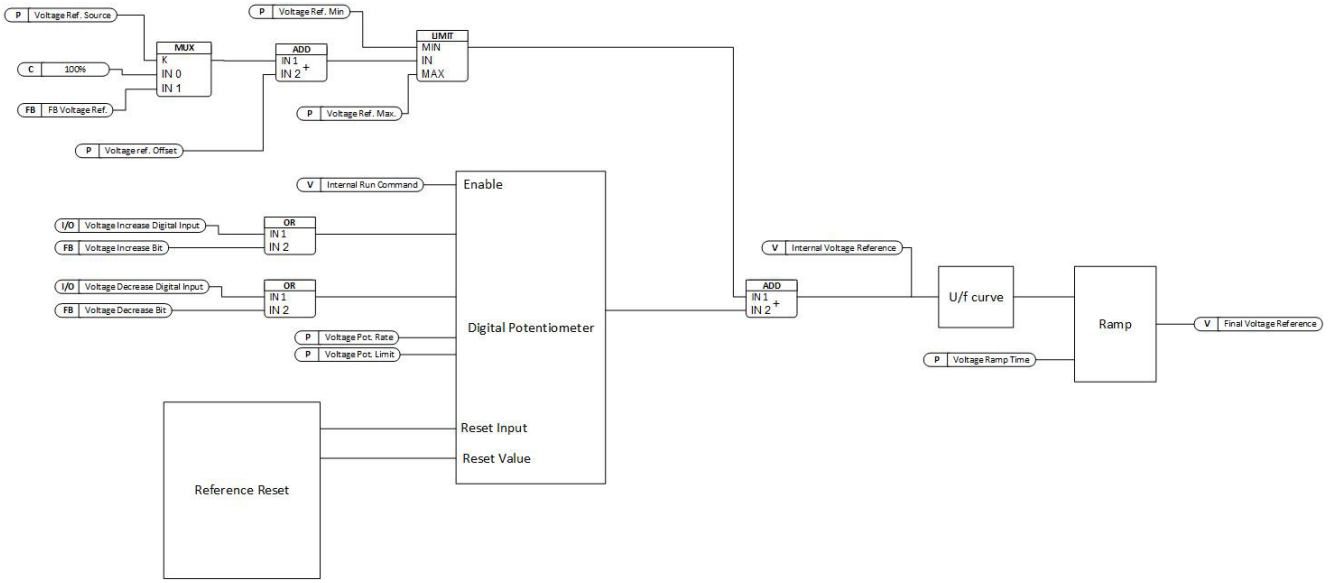
7.3.2.3 Grid Voltage Reference (Menu Index 2.2.3)

Grid Voltage reference is used to control the grid voltage as well as the reactive current/power delivered by the grid converter. The following is the reference chain diagram of grid voltage reference.

Figure 31: Grid Voltage Reference

P 2.2.3.1 Voltage Ref. Source No. 5066

Set the grid voltage reference source.



The following are the selections for the parameter.

Number	Name
0	100% of Grid Nominal Voltage
1	Fieldbus Reference

P 2.2.3.2 Min. Voltage Ref. No. 5067

Set the minimum grid voltage reference in % of the nominal grid voltage.

P 2.2.3.3 Max. Voltage Ref. No. 5068

Set the maximum grid voltage reference in % of the nominal grid voltage.

P 2.2.3.4 Voltage Incr. Input No. 5069

Set the digital input for grid voltage reference increase.

P 2.2.3.5 Voltage Decr. Input No. 5070

Set the digital input for grid voltage reference decrease.

P 2.2.3.6 Voltage Reset Input No. 5071

Set the digital input for grid voltage reference reset.

P 2.2.3.7 Voltage Ref. Offset No. 5072

Set the grid voltage reference offset in % of the nominal grid voltage.

P 2.2.3.8 Voltage Ref. Adjust Rate No. 5073

Set the grid voltage reference adjust rate in percentage per second of the nominal grid voltage.

P 2.2.3.9 Max. Voltage Ref. Adjust No. 5074

Set the maximum adjustment to the grid voltage reference in % of the grid nominal voltage.

P 2.2.3.10 Voltage Ref. Reset Stop State Value No. 5075

Grid voltage reference reset value in stop state.

The following are the selections for the parameter.

Number	Name	Description
0	No Reset	-
1	Reset to Grid Nominal	Reset the reference to grid nominal value at the falling edge of run state (run to stop).
2	Reset to Grid Actual	Reset the reference to grid actual value at the falling edge of run state (run to stop).

P 2.2.3.11 Voltage Ref. Reset I/O. Value No. 5076

Grid voltage reference reset value for I/O reset.

The following are the selections for the parameter.

Number	Name	Description
0	No Reset	-
1	Reset to Grid Nominal	Reset the reference to grid nominal value at the rising edge of Freq. Reset Input (No. 5055).
2	Reset to Grid Actual	Reset the reference to grid actual value at the rising edge of Freq. Reset Input (No. 5055).

P 2.2.3.12 Voltage Ref. Reset AFE Mode Value No. 5077

Grid voltage reference reset value in AFE mode.

The following are the selections for the parameter.

Number	Name	Description
0	No Reset	-
1	Reset to Grid Nominal	Reset the reference to grid nominal value when the operation mode is changed to any of the Grid Following Mode (for example AFE Mode).
2	Reset to Grid Actual	Reset the reference to grid actual value when the operation mode is changed to any of the Grid Following Mode (for example AFE Mode).

P 2.2.3.13 Voltage Ramp Time No. 5078

Ramp rate for grid voltage reference; defined in seconds from 0 to nominal grid voltage.

P 2.2.3.14 Field Weakning Point Freq. No. 5079

Set the field weakening frequency, below which grid voltage is linearly reduced as a function of grid frequency.

P 2.2.3.15 Voltage Droop Gain No. 5085

Set the voltage droop control gain.

P 2.2.3.16 Voltage Droop Tc No. 5086

Set the voltage droop control time constant.

P 2.2.3.17 Voltage Drooping Base Load Scale No. 5087

Set the base load scale. If the grid is isochronous (non-drooping), the reactive current will match the reference. If grid is drooping, it is possible to account for the drooping by adjusting the base load scale.

7.3.2.4 Grid Current Reference (Menu Index 2.2.4)

Grid Current reference is used to control the active current and reactive current. The following are the reference chains for both active and reactive current references.

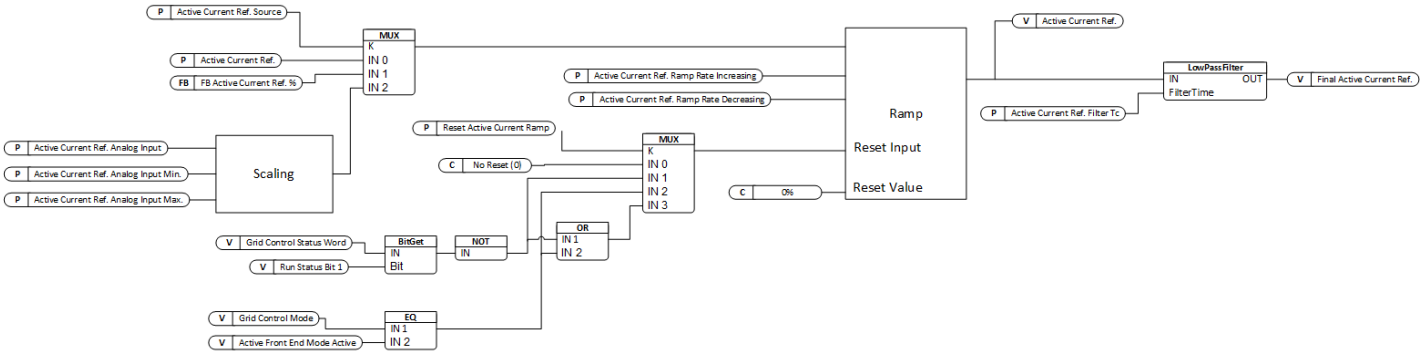


Figure 32: Active Current Reference

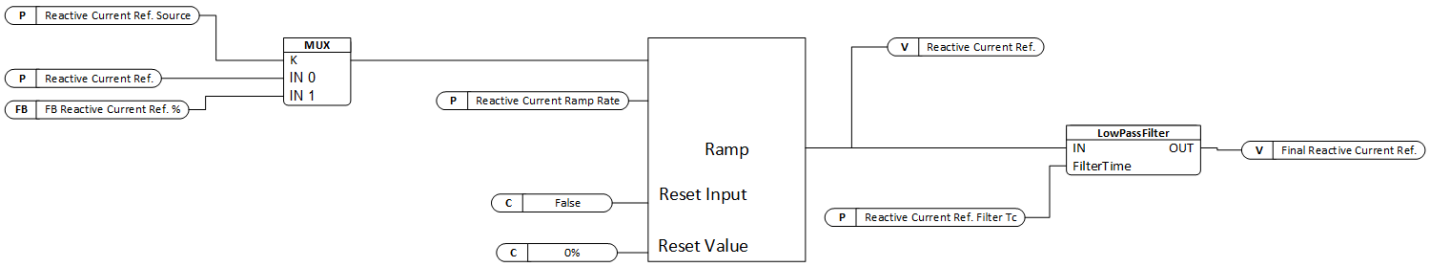


Figure 33: Reactive Current Reference

P 2.2.4.1 Active Current Ref. Source

Use to select the active current reference source.

The following are the selections for the parameter.

Number	Name
0	Parameter
1	Fieldbus Reference
2	Analog Input

P 2.2.4.2 Active Current Ref.

Set grid active current reference in % of the grid nominal current.

P 2.2.4.3 Active Current Ref. Ramp Rate Increasing

Set maximum rate of change for the grid active current reference when the latter is increased in absolute value. It is expressed in percent per second of the grid nominal current. When set to a negative value the rate limiting is disabled.

P 2.2.4.4 Active Current Ref. Ramp Rate Decreasing

Set maximum rate of change for the grid active current reference when the latter is decreased in absolute value. It is expressed in percent per second of the grid nominal current. When set to a negative value the rate limiting is disabled.

P 2.2.4.5 Active Current Ramp Reset

Set the reset condition for the grid active current reference ramp.

The following are the selections for the parameter.

Number	Name	Description
0	No Reset	The ramp is not reset.
1	Not Operating	The ramp is reset when in stop state or the MCB is open.
2	AFE Mode	The ramp is reset when AFE is the active operation mode.
3	Not Operating or AFE Mode	The ramp is reset when in stop state or the MCB is open or when AFE is the active operation mode.

P 2.2.4.6 Active Current Ref. Filter Tc

Active current reference low pass filter time constant.

P 2.2.4.7 Reactive Current Ref. Source

Use to select the reactive current reference source.

The following are the selections for the parameter.

Number	Name
0	Parameter
1	Fieldbus Reference

P 2.2.4.8 Reactive Current Ref.

Set grid reactive current reference in % of the grid nominal current.

P 2.2.4.9 Reactive Current Ramp Rate

Set grid reactive current reference ramp rate in percentage per second to the grid nominal current.

P 2.2.4.10 Reactive Current Ref. Filter Tc

Reactive current reference low pass filter time constant.

P 2.2.4.11 Active Current Ref. Analog Input

Select the analog input (terminal or fixed percentage value) for the active current reference.

P 2.2.4.12 Active Current Ref. Analog Input Min.

Set the minimum value for scaling the active current reference analog input signal.

P 2.2.4.13 Active Current Ref. Analog Input Max.

Set the maximum value for scaling the active current reference analog input signal.

7.3.2.5 Grid Power Reference (Menu Index 2.2.5)

Grid Converter also allows direct power reference for controlling active and reactive power.

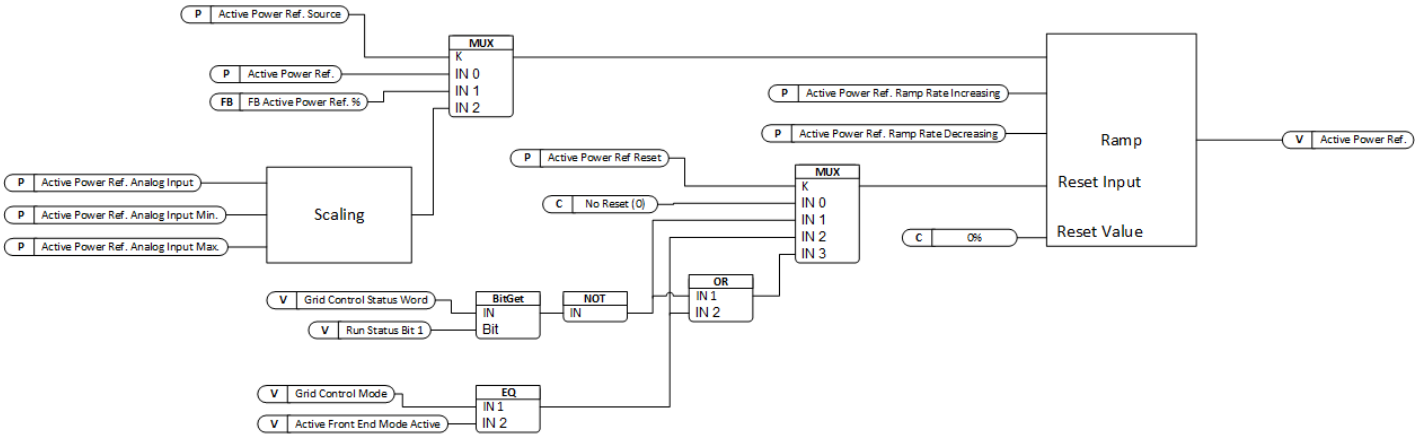


Figure 34: Active Power Reference

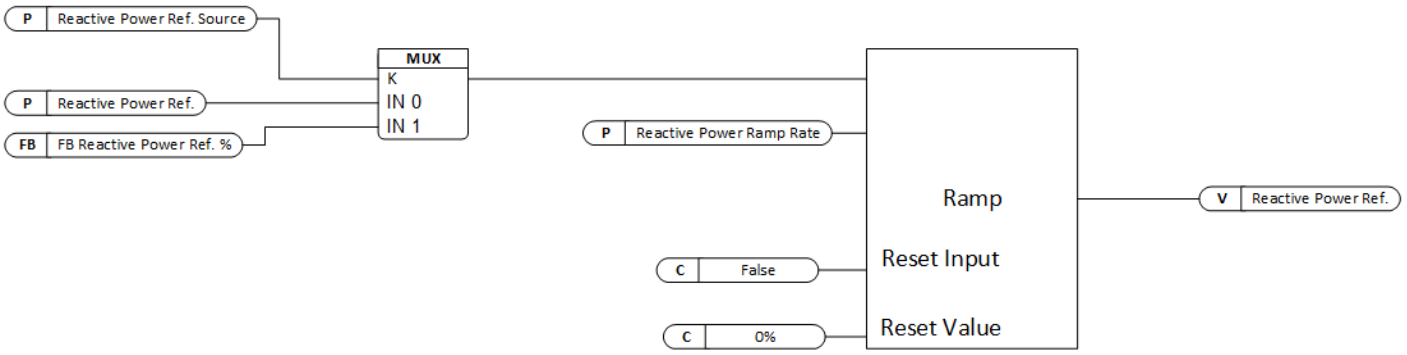


Figure 35: Reactive Power Reference

P 2.2.5.1 Active Power Ref. Source

Select the active power reference source.

The following are the selections for the parameter.

Number	Name
0	Parameter
1	Fieldbus Reference
2	Analog Input

P 2.2.5.2 Active Power Ref.

Set active power reference in % of the grid nominal power.

P 2.2.5.3 Active Power Ref. Ramp Rate Increasing

Set maximum rate of change for the grid active power reference when the latter is increased in absolute value. It is expressed in percent per second of the grid nominal power. When set to a negative value the rate limiting is disabled.

P 2.2.5.4 Active Power Ref. Ramp Rate Decreasing

Set maximum rate of change for the grid active power reference when the latter is decreased in absolute value. It is expressed in percent per second of the grid nominal power. When set to a negative value the rate limiting is disabled.

P 2.2.5.5 Active Power Ramp Reset

Set the reset condition for the grid active power reference ramp.

The following are the selections for the parameter.

Number	Name	Description
0	No Reset	The ramp is not reset.
1	Not Operating	The ramp is reset when in stop state or the MCB is open.
2	AFE Mode	The ramp is reset when AFE is the active operation mode.
3	Not Operating or AFE Mode	The ramp is reset when in stop state or the MCB is open or when AFE is the active operation mode.

P 2.2.5.6 Reactive Power Ref. Source

Select the reactive power reference source.

The following are the selections for the parameter.

Number	Name
0	Parameter
1	Fieldbus Reference

P 2.2.5.7 Reactive Power Ref.

Set reactive power reference in % of the grid nominal power.

P 2.2.5.8 Reactive Power Ref. Ramp

Set reactive power reference ramp rate in percentage per second of the grid nominal power.

P 2.2.5.9 Active Power Ref. Analog Input.

Select the analog input (terminal or fixed percentage value) for the active power reference.

P 2.2.5.10 Active Power Ref. Analog Input Min.

Set the minimum value for scaling the active power reference analog input signal.

P 2.2.5.11 Active Power Ref. Analog Input Max.

Set the maximum value for scaling the active power reference analog input signal.

7.3.2.6 DC-link Voltage Reference (Menu Index 2.2.6)

Grid Converter can regulate DC-link voltage in the Active Front End Mode. DC-link voltage reference is scaled based on DC-link Nominal Voltage. The minimum allowed reference from parameter and fieldbus is 100% of the DC-link Nominal Voltage. The maximum allowed reference from parameter and fieldbus is 150% of the DC-link Nominal Voltage. If needed a further offset can be added to the reference using the offset parameter which can expand the range to 80% to 170% of the DC-link Nominal Voltage.

$$Internal\ Ref.Scaling = \frac{DC-link\ Nominal\ Voltage * Transformer\ Grid\ Side\ Voltage}{\sqrt{2} * Grid\ Nominal\ Voltage * Transformer\ Converter\ Side\ Voltage}$$

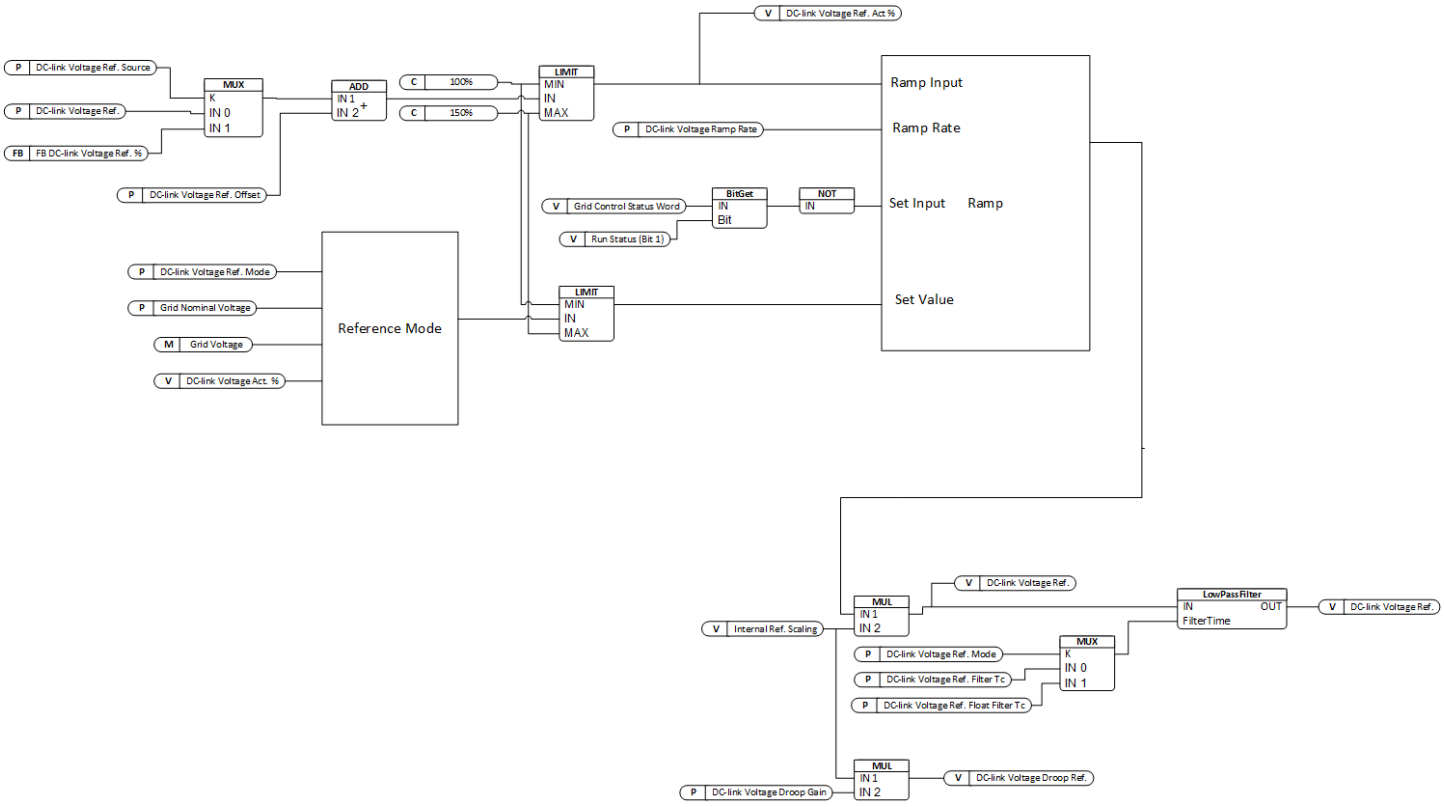


Figure 36: DC-link Voltage Reference

P 2.2.6.1 DC-link Voltage Ref. Source No. 2916

Select the source for the DC-link voltage reference.

The following are the selections for the parameter.

Number	Name
0	Parameter
1	Fieldbus Reference

P 2.2.6.2 DC-link Voltage Ref. No. 2910

Set the DC-link voltage reference. The percentage is calculated according to par. DC-link Voltage Ref. Mode (No. 2888).

P 2.2.6.3 DC-link Voltage Ref. Offset No. 2914

Set the DC-link voltage reference offset. The percentage is calculated according to par. DC-link Voltage Ref. Mode (No. 2888).

P 2.2.6.4 DC-link Voltage Droop Gain No. 2912

Set the DC-link voltage drooping gain; change of DC voltage reference per (active) current change.

P 2.2.6.5 DC-link Voltage Ramp Rate No. 2893

Set the maximum rate of change for the DC-link voltage reference, DC-link overvoltage and DC-link undervoltage controller limits.

P 2.2.6.6 DC-link Voltage Ref. Filter Tc No. 2894

Set the DC-link voltage reference low pass filter time constant.

P 2.2.6.7 DC-link Voltage Ref. Float Filter Tc No. 2895

Filtering time constant of actual grid voltage when floating reference mode is used.

P 2.2.6.8 DC-link Voltage Ref. Mode No. 2898

DC link voltage reference mode selection defines the base for the DC-link Voltage reference scaling. By default, the reference mode is set to '0' which provides a fixed scaling for the DC-link Voltage reference based on DC-link Nominal Voltage parameter. For the reference mode '1', the DC-link Voltage reference is scaled based on actual Grid Voltage rectified to DC-link Voltage. The reference mode '1' allows the selection of a floating reference base which will change if the Grid Voltage changes.

As an example, if Grid Nominal Voltage = 690V and DC-link Nominal Voltage =1000 V, then setting the dc-link voltage reference to 110% corresponds to 1100 V DC-link voltage if the reference mode is '0'. Alternatively, with the same settings, if reference mode '1' is selected then the final DC-link voltage depends on the Grid Voltage. If the Grid Voltage changes between 690V to 710V then with the same 110% reference, the DC-link Voltage will change according to 1.1*$\sqrt{2} * Grid\ Voltage$ -> 1073V to 1104V.

The following are the selections for the parameter.

Number	Name	Description
0	In % of Nominal DC-link Voltage	DC-link voltage reference is scaled based on DC-link Nominal Voltage
1	In % of actual rectified grid voltage (floating)	DC-link voltage reference is scaled based on actual rectified grid voltage.

7.3.2.7 DC-link Current Reference (Menu Index 2.2.7)

P 2.2.7.1 DC-link Current Ref. Source No. 6138

Select the DC-link current reference source.

The following are the selections for the parameter.

Number	Name
0	Parameter
1	Fieldbus Reference
2	Analog Input

P 2.2.7.2 DC-link Current Ref. No. 6136

Set the DC-link current reference (in % of the DC-link nominal current) when reference source is set to parameter.

P 2.2.7.3 DC-link Current Ramp Rate No. 6135

Set ramp rate for the DC-link current reference (-1 = disable ramp).

P 2.2.7.4 DC-link Current Ramp Reset No. 6137

Select when DC-link current reference ramp is reset.

The following are the selections for the parameter.

Number	Name
0	No Reset
1	Reset at Stop
2	Reset at AFE (DC-link Voltage Control) Mode
3	Reset either at Stop or AFE Mode

P 2.2.7.5 DC-link Current Ref. Filter Tc No. 6140

Set the DC-link current reference low-pass filter time constant.

P 2.2.7.6 DC-link Current Ref. Analog Input No. 6142

Select the analog input (terminal or as a percentage) for the DC-link current reference.

P 2.2.7.7 DC-link Current Ref. Analog Max. No. 6143

Set the maximum for DC-link current reference when reference source is set to analog input.

P 2.2.7.8 DC-link Current Ref. Analog Min. No. 6144

Set the minimum for DC-link current reference when reference source is set to analog input.

P 2.2.7.9 DC-Link Current Droop Curve U No. 5302

Set the voltage values (in % of the nominal DC-link voltage) for the DC-link current droop curve points.

P 2.2.7.10 DC-link Current Droop Curve I No. 5301

Set the current reference values (in % of the DC-link nominal current) for the DC-link current droop curve points.

P 2.2.7.11 DC-Link Current Droop Curve G No. 5300

Set DC-link current droop curve slopes.

7.3.2.8 DC-link Power Reference (Menu Index 2.2.8)

Grid Converter can control DC-link power with direct reference for the dc-link power.

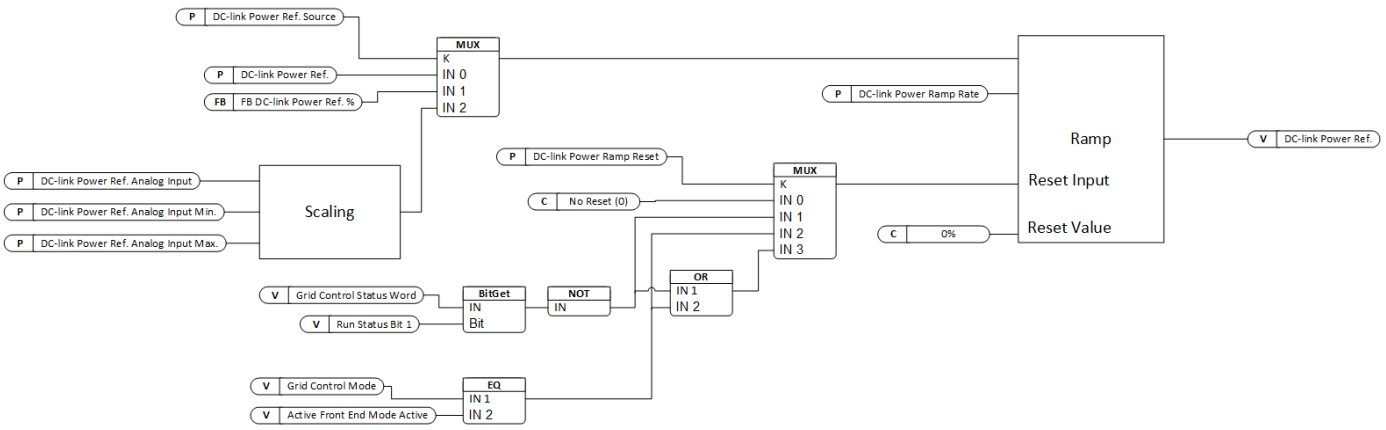


Figure 37: DC-link Power Reference

P 2.2.8.1 DC-link Power Ref. Source

Select the DC-link power reference source.

The following are the selections for the parameter.

Number	Name
0	Parameter
1	Fieldbus Reference
2	Analog Input

P 2.2.8.2 DC-link Power Ref.

Set the DC-link power reference when reference source is set to parameter.

P 2.2.8.3 DC-link Power Ramp Rate

Set ramp rate for the DC-link power reference (-1 = disable ramp).

P 2.2.8.4 DC-link Power Ramp Reset

Select when DC-link power reference ramp is reset.

The following are the selections for the parameter.

Number	Name
0	No Reset
1	Reset at Stop
2	Reset at AFE (DC-link Voltage Control) Mode
3	Reset either at Stop or AFE Mode

P 2.2.8.5 DC-link Power Ref. Analog Input

Select the analog input (terminal or as a percentage) for the DC-link power reference.

P 2.2.8.6 DC-link Power Ref. Analog Max.

Set the maximum for DC-link power reference when reference source is set to analog input.

P 2.2.8.7 DC-link Power Ref. Analog Min.

Set the minimum for DC-link power reference when reference source is set to analog input.

7.3.3 Limits (Menu Index 2.3)

7.3.3.1 Grid Current Limit (Menu Index 2.3.1)

Grid current limits are defined by overall current limit, negative active current limit, and positive active current limit. Both negative and positive current limits are used as process limits. These process current limits can be ramped up (away from 0) with ramp rate defined by the respective parameter. Ramp down is instantaneous except in situations when a warning with ramp current limit down response is active. In that case, the limits are brought down first to the actual current and then ramped down (towards warning active preset).

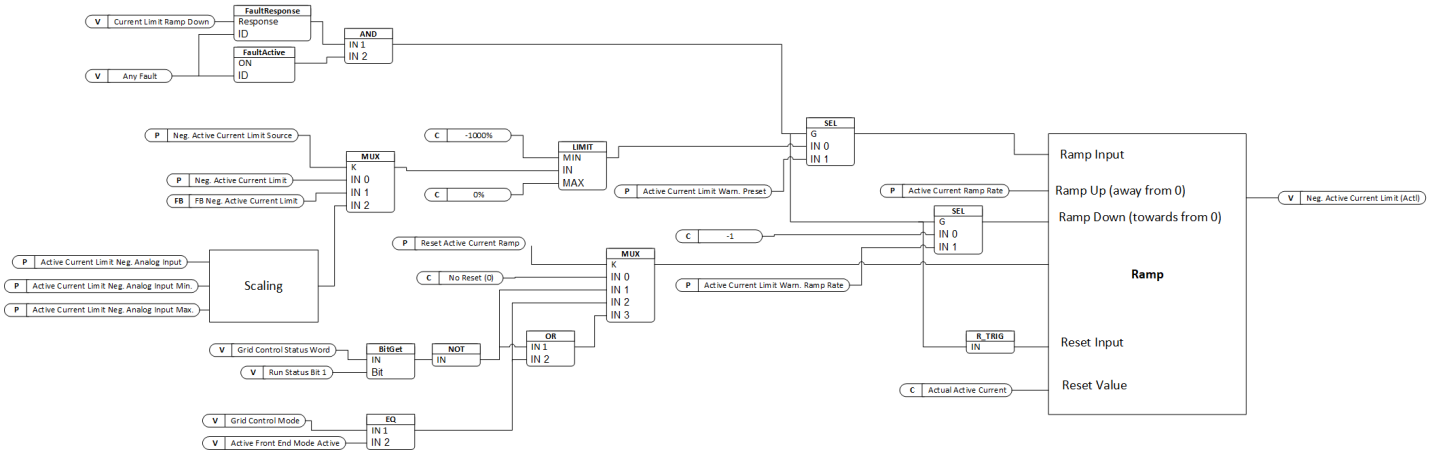


Figure 38: Negative Active Current Limit

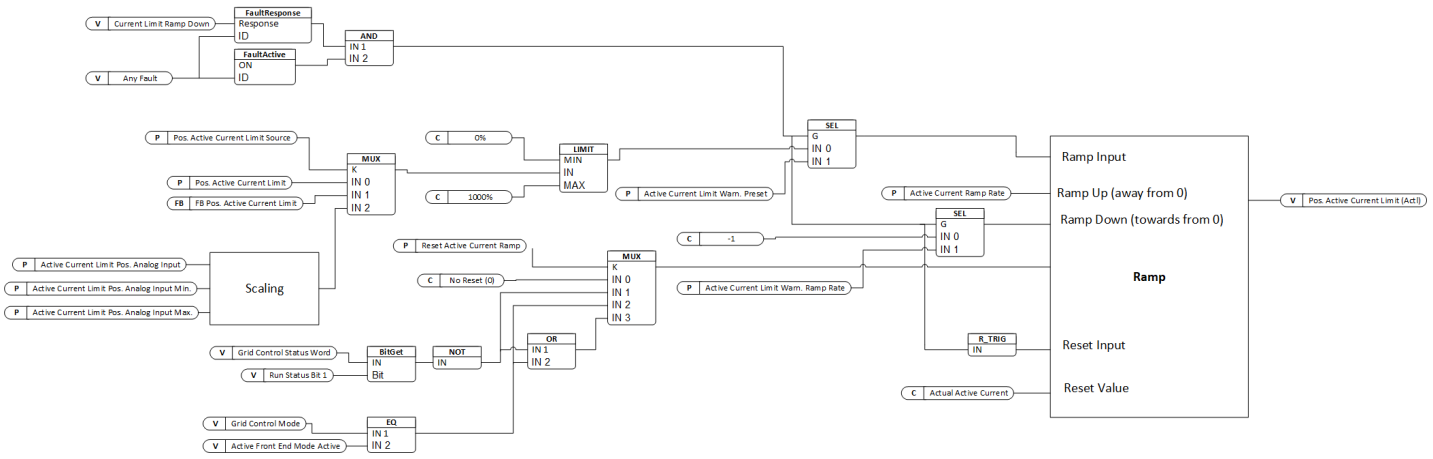


Figure 39: Positive Active Current Limit

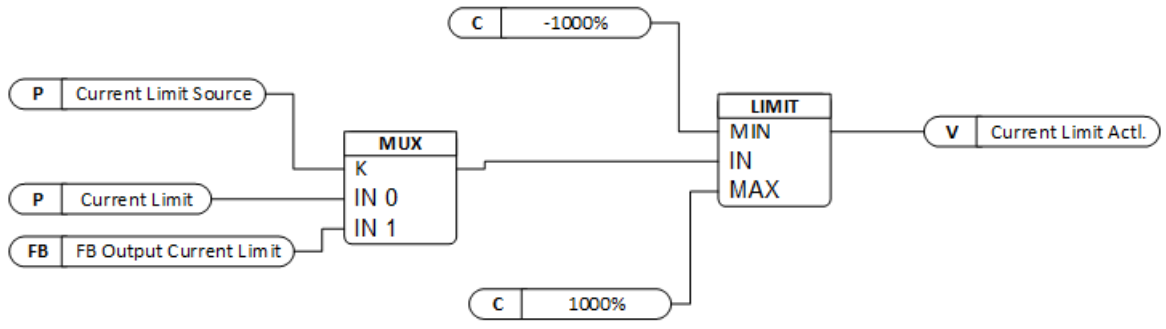


Figure 40: Current Limit

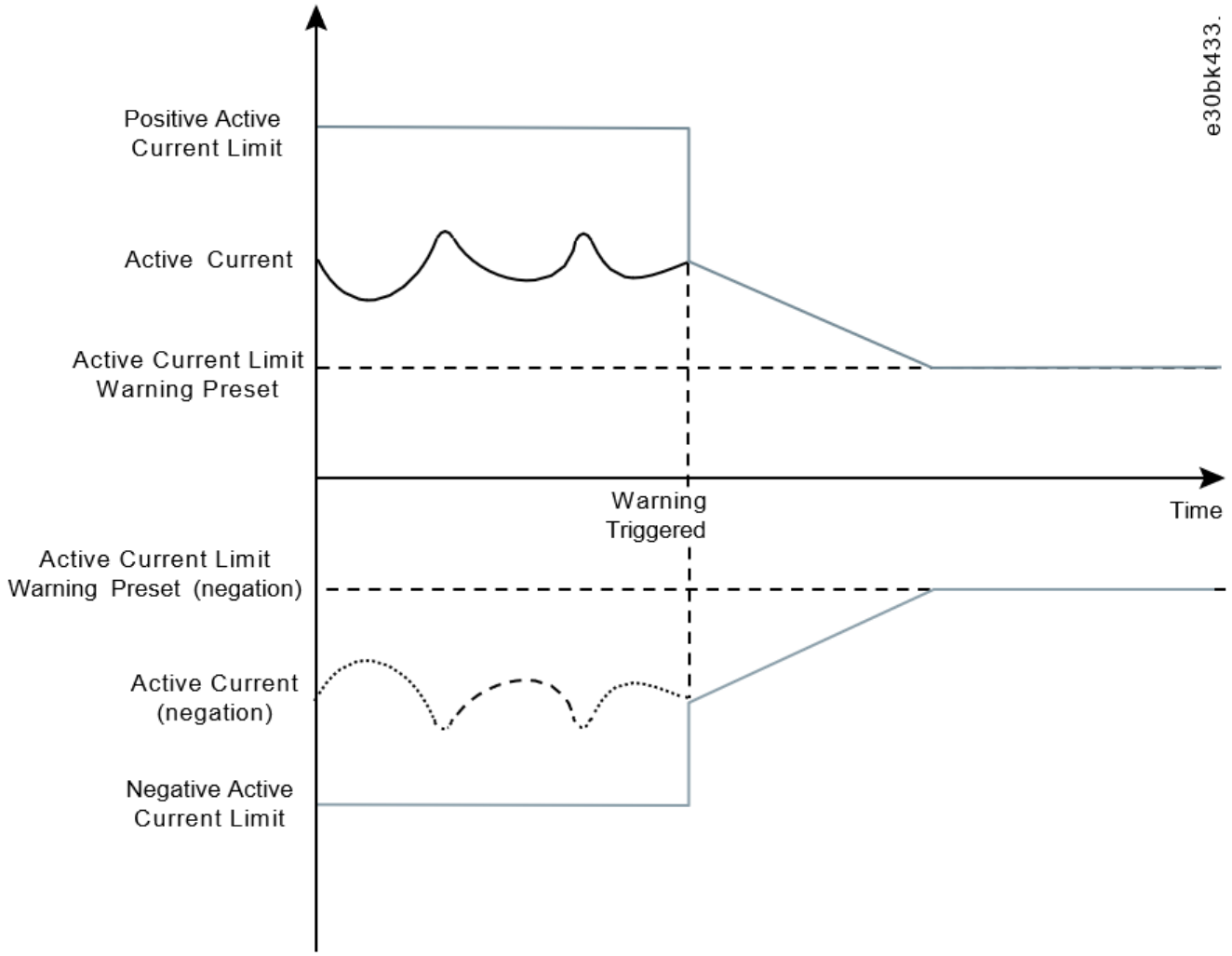


Figure 41: Current Limit Ramp Down with warning active

P 2.3.1.1 Enable Freq. Based Current Limit No. 2343

Enable current limit control using PQ active current control. This parameter enables active current limit control for grid forming control. When the current limit is reached the converter will adjust output frequency to limit active current.

The following are the selections for the parameter.

Number	Name
0	Disabled
1	Enabled.

P 2.3.1.2 Current Limit Priority No. 2853

Set current limit priority configuration. If the current limit regulator is active, then it will start limiting either the Active or Reactive Current based on the selection of this parameter.

The following are the selections for the parameter.

Number	Name
0	Active Current
1	Reactive Current

P 2.3.1.3 Neg. Active Current Limit Source No. 2854

Select the source for the active current limit in negative direction.

The following are the selections for the parameter.

Number	Name
0	Parameter
1	Fieldbus Reference
2	Analog Input

P 2.3.1.4 Neg. Active Current Limit No. 2855

Set the active current limit in negative direction in % of the grid nominal current.

P 2.3.1.5 Neg. Active Current Limit Ramp Up Rate No. 2856

Set the ramp rate for the active current limit in negative direction in % (of the grid nominal current) per second. This ramp rate is applied only when the limit is increased in absolute value.

P 2.3.1.6 Pos. Active Current Limit Source No. 2857

Select the source for the active current limit in a positive direction.

The following are the selections for the parameter.

Number	Name
0	Parameter
1	Fieldbus Reference
2	Analog Input

P 2.3.1.7 Pos. Active Current Limit **No. 2858**

Set the active current limit in a positive direction in % of the grid nominal current.

P 2.3.1.8 Current Limit Source **No. 2852**

Current magnitude limit source selection.

The following are the selections for the parameter.

Number	Name
0	Parameter
1	Fieldbus Reference

P 2.3.1.9 Current Limit **No. 2851**

Output current limit in % of the grid nominal current.

P 2.3.1.10 Active Current Limit Pos. Analog Input **No. 6576**

Select the analog input (terminal or fixed percentage value) for the active current limit pos.

P 2.3.1.11 Active Current Limit Pos. Analog Input Min. **No. 6575**

Set the minimum value for scaling the active current limit positive analog input signal.

P 2.3.1.12 Active Current Limit Pos. Analog Input Max. **No. 6574**

Set the maximum value for scaling the active current limit positive analog input signal.

P 2.3.1.13 Active Current Limit Neg. Analog Input **No. 6577**

Select the analog input (terminal or fixed percentage value) for the active current limit neg.

P 2.3.1.14 Active Current Limit Neg. Analog Input Min. **No. 6579**

Set the minimum value for scaling the active current limit negative analog input signal.

P 2.3.1.15 Active Current Limit Neg. Analog Input Max. **No. 6578**

Set the maximum value for scaling the active current limit negative analog input signal.

7.3.3.2 Grid Power Limit (Menu Index 2.3.2)

Grid power limits are controlled using negative and positive active power limits.

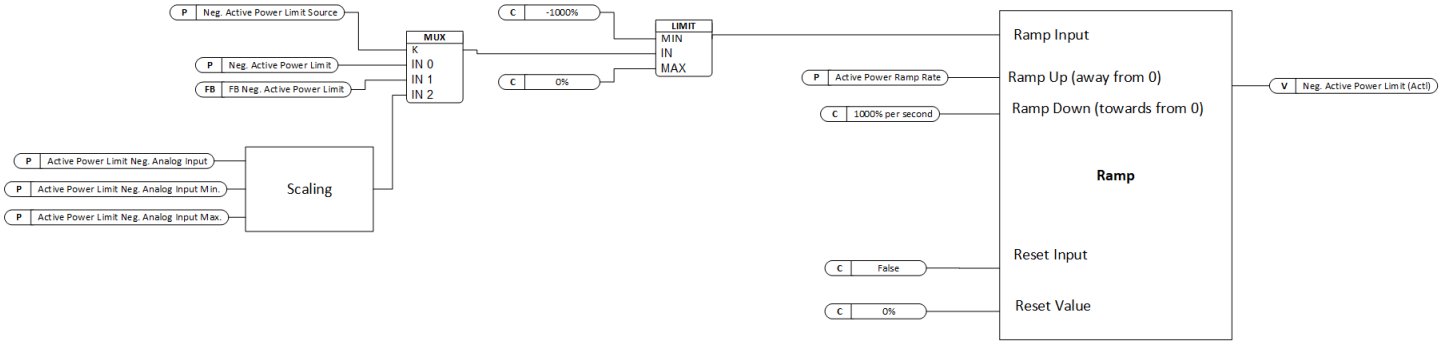


Figure 41: Negative Active Power Limit

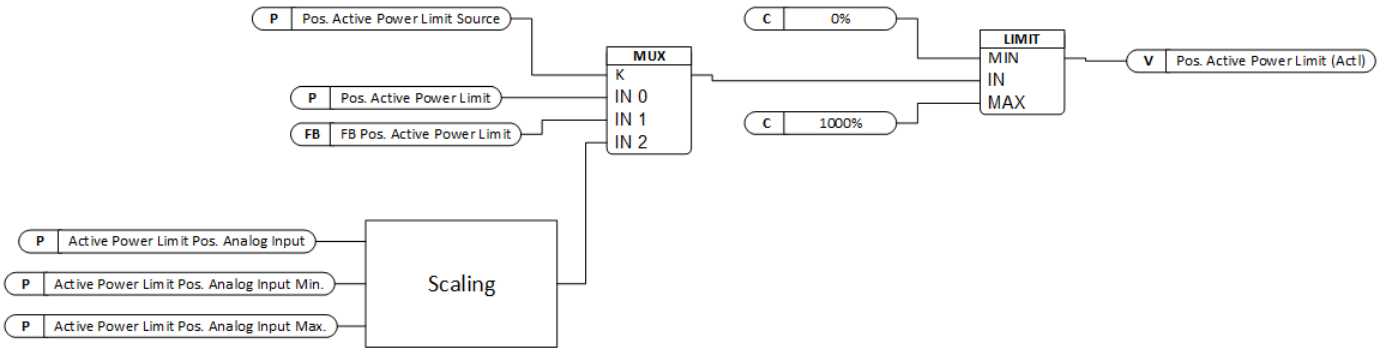


Figure 42: Positive Active Power Limit

P 2.3.2.1 Neg. Active Power Limit Source No. 2861

Select the source for the active power limit in negative direction.

The following are the selections for the parameter.

Number	Name
0	Parameter
1	Fieldbus Reference
2	Analog Input

P 2.3.2.2 Neg. Active Power Limit No. 2862

Set the active power limit in negative direction in % of the grid nominal power.

P 2.3.2.3 Neg. Active Power Limit Ramp Up Rate No. 2863

Set the ramp rate for the active power limit in negative direction in % (of the grid nominal power) per second. This ramp rate is applied only when the limit is increased in absolute value.

P 2.3.2.4 Pos. Active Power Limit Source **No. 2864**

Select the source for the active power limit in a positive direction.

The following are the selections for the parameter.

Number	Name
0	Parameter
1	Fieldbus Reference
2	Analog Input

P 2.3.2.5 Pos. Active Power Limit **No. 2865**

Set the active power limit in a positive direction in % of the grid nominal power.

P 2.3.2.6 Active Power Limit Neg. Analog Input **No. 6580**

Select the analog input (terminal or fixed percentage value) for the active power limit negative.

P 2.3.2.7 Active Power Limit Neg. Analog Input Min **No. 6582**

Set the maximum value for scaling the active power limit negative analog input signal.

P 2.3.2.8 Active Power Limit Neg. Analog Input Max. **No. 6581**

Set the maximum value for scaling the active power limit negative analog input signal.

P 2.3.2.9 Active Power Limit Pos. Analog Input **No. 6583**

Select the analog input (terminal or fixed percentage value) for the active power limit positive.

P 2.3.2.10 Active Power Limit Pos. Analog Input Min. **No. 6585**

Set the minimum value for scaling the active power limit positive analog input signal.

P 2.3.2.11 Active Power Limit Pos. Analog Input Max. **No. 6584**

Set the maximum value for scaling the active power limit positive analog input signal.

7.3.3.3 Short Term Current Injection (Menu Index 2.3.3)

P 2.3.3.1 Short Term Current Enabled

Enables the short term current injection function.

The following are the selections for the parameter.

Number	Name
0	Disabled
1	Enabled.

P 2.3.3.2 Short Term Current Limit

Maximum current for short term current injection in % of grid nominal current.

P 2.3.3.3 Short Term Current Time

Maximum time for short term current injection in seconds.

P 2.3.3.4 Short Term Current Mode

Select the short term current injection mode:

The following are the selections for the parameter.

Number	Name	Description
0	No reset.	Internal current limit ramped to Short Term Current Limit.
1	Reset before ramping.	Current limit is reset to 0 before ramped up to Short Term Curren Limit.
2	Automatic reset.	Reset if power flow before the short circuit is from grid to dc-link. No reset if power flow is from dc-link to grid.

P 2.3.3.5 Short Term Current Switching Freq.

Minimum switching frequency during short term current injection.

7.3.3.4 DC Link Voltage Limiters (Menu Index 2.3.4)

Grid Converter has both DC-link over and under voltage controller limits available as references. Over and undervoltage limits have dependency on Unit Voltage Class (No. 2832) and changing the voltage class will change the limits.

$$Internal\ Ref.Scaling = \frac{DC - link\ Nominal\ Voltage * Transformer\ Grid\ Side\ Voltage}{\sqrt{2} * Grid\ Nominal\ Voltage * Transformer\ Converter\ Side\ Voltage}$$

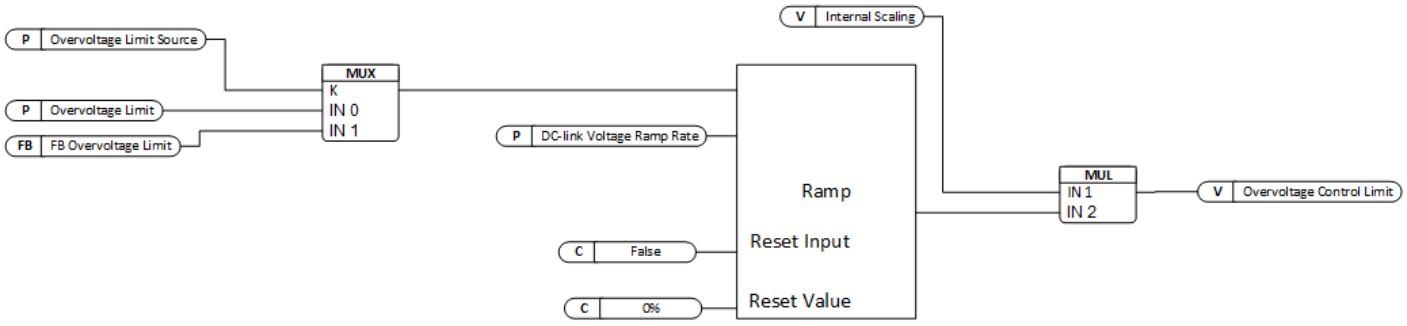


Figure 43: Overvoltage Limit Reference

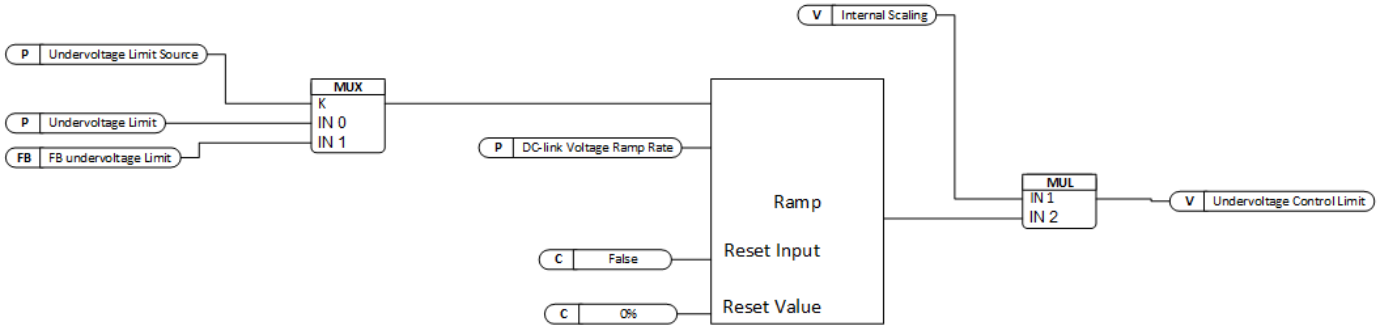


Figure 44: Undervoltage Limit Reference

7.3.3.4.1 Undervoltage Limit Controller (Menu Index 2.3.4.1)

P 2.3.4.1.1 Undervoltage Control **No. 1809**

Enables the DC-link undervoltage controller.

The following are the selections for the parameter.

Number	Name
0	Disabled
1	Enabled.

P 2.3.4.1.2 Undervoltage Limit Source **No. 2900**

Select the source for the DC-link undervoltage controller limit.

The following are the selections for the parameter.

Number	Name
0	Parameter
1	Fieldbus Reference

P 2.3.4.1.3 Undervoltage Limit **No. 2901**

Set the DC-link undervoltage limit in % of the DC-link nominal voltage.

7.3.3.4.2 Overvoltage Limit Controller (Menu Index 2.3.4.2)

P 2.3.4.2.1 Overvoltage Control **No.1802**

Enables the DC-link overvoltage controller.

The following are the selections for the parameter.

Number	Name
0	Disabled
1	Enabled.

P 2.3.4.2.2 Overvoltage Limit Source **No. 2897**

Select the source for the DC-link overvoltage controller limit.

The following are the selections for the parameter.

Number	Name
0	Parameter
1	Fieldbus Reference

P 2.3.4.2.3 Overvoltage Limit

Set the DC-link overvoltage limit in % of the DC-link nominal voltage.

7.3.4 Digital and Analog Inputs (Menu Index 2.4)

7.3.4.1 Digital Input Selection List

For selection of digital inputs, a dynamically generated selection list of available terminals is generated based on the slot number of the IO & Relay option board. For example, a snapshot of possibly available options seen through MyDrive Insight with a single IO & Relay option board of slot 202 is shown in the following image:

7.3.4.2 Digital Inputs (Menu Index 2.4.1)

P 2.4.1.1 Run Enable Input **No. 103**

Select an input for enabling the converter to run. Run Enable is a mandatory signal for the converter to run. If removed in the run state then it will stop the converter and the converter will not go into run state without issuing this signal back.

P 2.4.1.2 External Event 1 Input **No. 4557**

Select an input for activating the external warning/fault 1.

P 2.4.1.3 External Event 2 Input **No. 4560**

Select an input for activating the external warning/fault 2.

P 2.4.1.4 Cooling Monitor Input **No. 2400**

Select an input for the cooling monitor signal. Cooling Monitor warning/fault is activated when this input becomes FALSE.

P 2.4.1.5 Force I/O Control Input **No. 4513**

Select an input for forcing the control place to I/O.

P 2.4.1.6 Force FB Control Input **No. 4511**

Select an input for forcing the control place to Fieldbus.

P 2.4.1.7 I/O Start Input **No. 200**

Select an input for starting the unit when the active control place is I/O Control.

P 2.4.1.8 I/O Stop Input **No. 201**

Select an input for stopping the unit when the active control place is I/O Control. Stop is activated when this input becomes FALSE.

P 2.4.1.9 I/O Reset Input **No. 203**

Select an input for the warning/fault reset when the active control place is I/O Control. The dependence on control place is selected based on Control Place Independent Reset (No. 109).

P 2.4.1.10 Switch On Enable Input No. 4728

Select a digital input for enabling the converter to force open the main circuit breaker if the signal becomes low. The converter will not start if the Switch On Enable Input is low.

P 2.4.1.11 Pre Charge Request Inp. No. 6567

Set the digital input for starting the pre charge. This input will start the pre charge and the main circuit breaker will close based on the closing mode.

P 2.4.1.12 MCB Close Enable Input No. 6557

Set the digital input for main circuit breaker closing enable. Main circuit breaker will not close without this signal. If removed in the run state, then it will open the main circuit breaker. The converter will not go into the run state without this signal.

P 2.4.1.13 MCB Feedback Close Input No. 6552

Set the digital input for main circuit breaker closing feedback.

P 2.4.1.14 MCB Feedback Open Input No. 6553

Set the digital input for main circuit breaker opening feedback.

P 2.4.1.15 MCB Tripped Input No. 6554

Set the digital input for main circuit breaker tripped feedback.

P 2.4.1.16 Freq. Reset Input No. 5055

Set the digital input for grid frequency reference reset.

P 2.4.1.17 Freq. Decrease. Input No. 5054

Set the digital input for grid frequency reference decrease.

P 2.4.1.18 Freq. Increase. Input No. 5053

Set the digital input for grid frequency reference increase.

P 2.4.1.19 Voltage Reset Input No. 5071

Set the digital input for grid voltage reference reset.

P 2.4.1.20 Voltage Decr. Input No. 5070

Set the digital input for grid voltage reference decrease.

P 2.4.1.21 Voltage Incr. Input No. 5069

Set the digital input for grid voltage reference increase.

P 2.4.1.22 Quick Stop Input No. 212

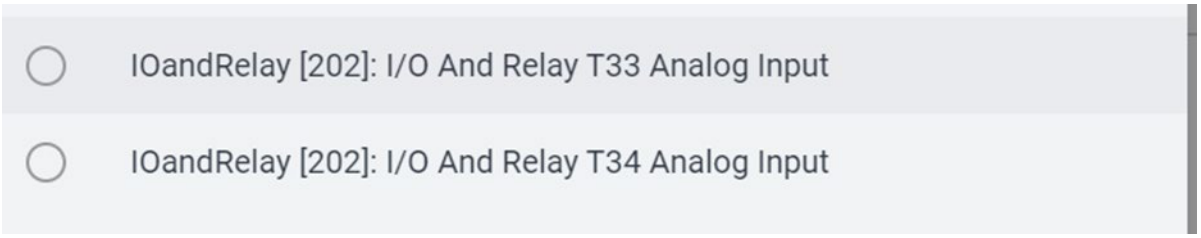
Select an input for the Quick Stop function. Quick Stop is activated when this input becomes FALSE. In addition to stopping the unit, Quick Stop will open the main circuit breaker (if controlled by the converter) irrespective of the selected response.

P 2.4.1.23 Quick Stop Input 2 No. 5104

Select an input for the Quick Stop function. Quick Stop is activated when this input becomes FALSE. In addition to stopping the unit, Quick Stop will open the main circuit breaker (if controlled by the converter) irrespective of the selected response.

7.3.4.3 Analog Inputs Selection List

For selection of analog inputs, a dynamically generated selection list of available terminals is generated based on the slot number of the IO & Relay option board. For example, a snapshot of possibly available options seen through MyDrive Insight with a single IO & Relay option board of slot 202 is shown in the following image:



7.3.4.4 Analog Inputs (Menu Index 2.4.2)

P 2.4.2.1 Active Current Ref. Analog Input No. 6571

Select the analog input (terminal or fixed percentage value) for the active current reference.

P 2.4.2.2 Active Current Limit Neg. Analog Input No. 6577

Select the analog input (terminal or fixed percentage value) for the active current limit neg.

P 2.4.2.3 Active Current Limit Pos. Analog Input No. 6576

Select the analog input (terminal or fixed percentage value) for the active current limit pos.

P 2.4.2.4 Active Power Limit Neg. Analog Input No. 6580

Select the analog input (terminal or fixed percentage value) for the active power limit negative.

P 2.4.2.5 Active Power Limit Pos. Analog Input No. 6583

Select the analog input (terminal or fixed percentage value) for the active power limit positive.

P 2.4.2.6 Active Power Ref. Analog Input. No. 6593

Select the analog input (terminal or fixed percentage value) for the active power reference.

P 2.4.2.7 DC-link Current Ref. Analog Input No. 6142

Select the analog input (terminal or as a percentage) for the DC-link current reference.

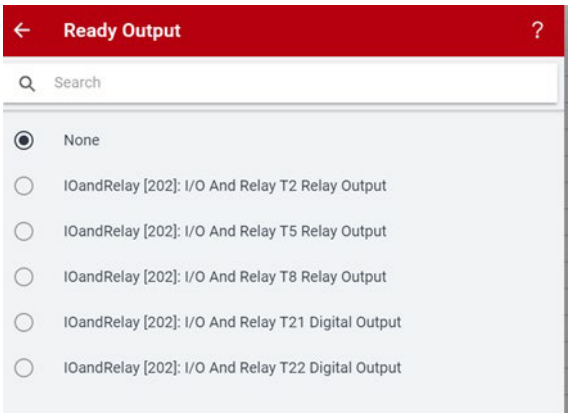
P 2.4.2.8 DC-link Power Ref. Analog Input No. 7694

Select the analog input (terminal or as a percentage) for the DC-link power reference.

7.3.5 Digital and Analog Outputs (Menu Index 2.5)

7.3.5.1 Digital Outputs Selection List

For selection of digital outputs, a dynamically generated selection list of available terminals is generated based on the slot number of the IO & Relay option board. For example, a snapshot of possibly available options seen through MyDrive Insight with a single IO & Relay option board of slot 202 is shown in the following image:



7.3.5.2 Digital Outputs (Menu Index 2.5.1)

P 2.5.1.1 Ready Output **No. 205**

Select an output for the Ready to run signal.

P 2.5.1.2 Run Output **No. 206**

Select an output for the Run-signal.

P 2.5.1.3 Static Fault Output **No. 208**

Select an output for the Static Fault Active signal.

P 2.5.1.4 Static Warning Output **No. 209**

Select an output for the Static Warning Active signal.

P 2.5.1.5 Toggling Fault Output **No. 5180**

Select an output for the Toggling Fault-signal. This signal goes down for 1 second whenever a new fault is registered while another fault was already active.

P 2.5.1.6 Toggling Warning Output **No. 5181**

Select an output for the Toggling Warning-signal. This signal goes down for 1 second whenever a new warning is registered while another warning was already active.

P 2.5.1.7 FB CTW Bit 12 Output **No. 5193**

Select an output for the status of the fieldbus control word bit 12.

P 2.5.1.8 FB CTW Bit 13 Output **No. 5194**

Select an output for the status of the fieldbus control word bit 13.

P 2.5.1.9 FB CTW Bit 14 Output **No. 5198**

Select an output for the status of the fieldbus control word bit 14.

P 2.5.1.10 FB CTW Bit 15 Output **No. 5191**

Select an output for the status of the fieldbus control word bit 15.

P 2.5.1.11 DC-link Voltage Superv. Output **No. 5157**

Select an output for the status of the DC-link Voltage Supervision. Signals when the DC-link voltage exceeds Param. DC-link Voltage Superv. Limit (No. 5158).

P 2.5.1.12 DC-link Voltage Superv. Limit **No. 5158**

Set the DC-link Voltage Supervision Limit for monitoring the DC-link Voltage with a digital output.

P 2.5.1.13 Local Control Active Output **No. 5178**

Select an output terminal indicating that the converter is in local control.

P 2.5.1.14 I/O Control Active Output **No. 5177**

Select an output terminal indicating that the converter is in I/O control.

P 2.5.1.15 Fieldbus Control Active Output **No. 5197**

Select an output terminal indicating that the converter is in fieldbus control.

P 2.5.1.16 Active Exception 1 Output **No. 5189**

Select an output for monitoring the warning/fault activation status (output high = exception active).

P 2.5.1.17 Event 1 Number **No. 5188**

Set the number of the event to be assigned for Active Event 1 output.

P 2.5.1.18 Active Event 2 Output **No. 5190**

Select an output for monitoring the warning/fault activation status (output high = event active).

P 2.5.1.19 Event 2 Number **No. 5290**

Set the number of the event to be assigned for Active Event 2 output.

P 2.5.1.20 Limit Supervision 1 Output **No. 5254**

Select the output terminal for the Limit Supervision 1 active indication.

P 2.5.1.21 No Warning Output **No. 217**

Select an output for the No Warning Active signal.

P 2.5.1.22 No Fault Output **No. 218**

Select an output for the No Fault Active signal.

P 2.5.1.23 Local Control Forcing Requested Output **No. 125**

Select an output terminal for the indication that the control place forcing to Local Control has been requested with REM/LOC button of control panel (output high = requested).

P 2.5.1.24 I/O Forcing Requested Output **No. 121**

Select an output terminal for the indication that the control place forcing to I/O Control has been requested (output high = requested).

P 2.5.1.25 FB Forcing Requested Output **No. 120**

Select an output terminal for the indication that the control place forcing Fieldbus Control has been requested (output high = requested).

P 2.5.1.26 Pre-Charge Request Output **No. 6563**

Set pre-charging command digital output.

P 2.5.1.27 Pre-charge Allowed Output **No. 6569**

Set the digital output terminal for pre-charging allowed.

P 2.5.1.28 MCB Close Output **No. 6551**

Set the digital output for main circuit breaker closing.

P 2.5.1.29 MCB Close Pulse Output **No. 6555**

Set the digital output for main circuit breaker closing pulse command.

P 2.5.1.30 MCB Open Pulse Output **No. 6556**

Set the digital output for main circuit breaker opening pulse command.

7.3.5.3 Delayed Digital Outputs (Menu Index 2.5.2)

P 2.5.2.1 Delayed Output 1 Content Sel. **No. 8032**

Select the function for the delayed digital output 1.

The following are the selections for the parameter.

Number	Name	Description
0	Not used	-
1	Drive Ready Status	Drive ready status signal. True = Drive ready, False = Drive not ready.
2	Drive Running Status	Drive running status signal. True = Drive is running, False = Drive is not running.
3	Warning Active (Static)	Static warning active status signal. True = One or more warnings are active, False = No warnings are active.
4	Fault Active (Static)	Static fault active status signal. True = One or more faults are active, False = No faults are active.
5	Local Control Active	Local control active status signal. True = Converter is controlled from I/O control place, False = Converter is not controlled from I/O control place.
6	I/O Control Active	I/O control active status signal. True = Converter is controlled from I/O control place, False = Converter is not controlled from I/O control place.
7	FB Control Active	Fieldbus control active status signal. True = Drive is controlled from Fieldbus control place, False = Drive is not controlled from Fieldbus control place.
8	Warning Active (Toggled)	Toggled warning active status signal. This signal will toggle down for 1 second, whenever a new warning is activated while another warning was already active.
9	Fault Active (Toggled)	Toggled fault active status signal. This signal will toggle down for 1 second, whenever a new fault is activated while another fault was already active.
10	CTW Bit 12	Fieldbus Control word - bit 12.
11	CTW Bit 13	Fieldbus Control word - bit 13.
12	CTW Bit 14	Fieldbus Control word - bit 14.
13	CTW Bit 15	Fieldbus Control word - bit 15.
14	DC-link Voltage Supervision	

P 2.5.2.2 Delayed Output 1 On Delay **No. 8036**

Set the on delay for the delayed digital output 1.

P 2.5.2.3 Delayed Output 1 Off Delay **No. 8038**

Set the off delay for the delayed digital output 1.

P 2.5.2.4 Delayed Output 1 Output **No. 8040**

Select the output for transmitting the delayed digital output 1.

P 2.5.2.5 Delayed Output 2 Content Sel. **No. 8033**

Select the function for the delayed digital output 2. The selection list is the same as for Delayed Output 1 Content Sel.

P 2.5.2.6 Delayed Output 2 On Delay **No. 8037**

Set the on delay for the delayed digital output 2.

P 2.5.2.7 Delayed Output 2 Off Delay **No. 8039**

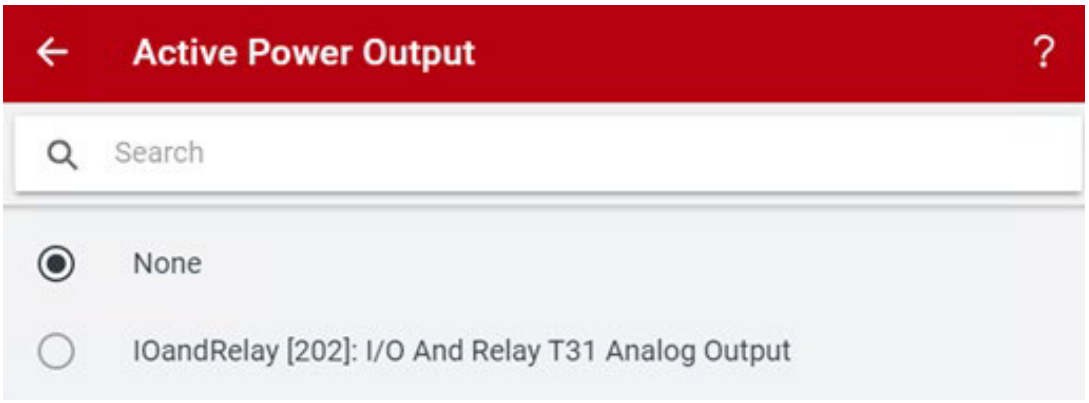
Set the off delay for the delayed digital output 2.

P 2.5.2.8 Delayed Output 2 Output **No. 8041**

Select the output for transmitting the delayed digital output 2.

7.3.5.4 Analog Outputs Selection List

For selection of analog outputs a dynamically generated selection list of available terminals is generated based on the slot number of the IO & Relay option board. For example, a snapshot of possibly available options seen through MyDrive Insight with a single IO & Relay option board of slot 202 is shown in the following image:



7.3.5.5 Analog outputs (Menu Index 2.5.3)

P 2.5.3.1 Active Current Output **No. 2450**

Select an analog output for the active current -signal.

P 2.5.3.2 Absolute Active Current Output **No. 2451**

Select an analog output for the absolute active current signal.

Reactive Current Output **No. 2452**

Select an analog output for the reactive current signal.

P 2.5.3.4 Output Current Output **No. 2453**

Select an analog output for the output current -signal.

P 2.5.3.5 Power Factor Output **No. 2457**

Select an analog output for the power factor -signal.

P 2.5.3.6 Absolute Active Power Output **No. 2456**

Select an analog output for the absolute grid active power -signal.

P 2.5.3.7 Active Power Output **No. 2455**

Select an analog output for the grid active power -signal.

P 2.5.3.8 Active Power Output Max. **No. 2458**

Set the maximum active power value for analog output scaling maximum.

P 2.5.3.9 Active Power Output Min. **No. 2459**

Set the minimum active power value for analog output scaling minimum.

P 2.5.3.10 DC-link Voltage Output **No. 2454**

Select an analog output for the DC-link voltage signal.

P 2.5.3.11 DC-link Voltage Output Max. **No. 2460**

Set the maximum DC-link voltage value for analog output scaling maximum.

P 2.5.3.12 DC-link Voltage Output Min. **No. 2461**

Set the minimum DC-link voltage value for analog output scaling to a minimum.

P 2.5.3.13 Main Fan Speed Output **No. 2462**

Select an analog output for the main fan speed -signal.

P 2.5.3.14 Main Fan Speed Output Max. **No. 2463**

Set the maximum main fan speed value for analog output scaling maximum.

P 2.5.3.15 Main Fan Speed Output Min. **No. 2464**

Set the minimum main fan speed value for analog output scaling minimum.

P 2.5.3.16 DC-link Current Output **No. 2465**

Select an analog output for the DC-link current -signal.

P 2.5.3.17 DC-link Current Output Max. **No. 2466**

Set the maximum DC-link current value for analog output scaling maximum.

P 2.5.3.18 DC-link Current Output Min. **No. 2467**

Description: Set the minimum DC-link current value for analog output scaling minimum.

7.3.6 Start and Stop Settings (Menu Index 2.6)

Start and stop settings group define the parameters which must be configured to define the start and stop behavior of the converter. There are 4 start and run interlocks. These are Run Enable, Switch On Enable, MCB Close Enable and No Quick Stop Active. All the interlocks need to be true before the converter can start modulation. If any of the interlocks are removed in the run state, then it will stop the converter.

7.3.6.1 Start Settings (Menu Index 2.6.1)

P 2.6.1.1 Start Delay **No. 4718**

Set a delay to start the converter. The parameter can be set if there are multiple converters connected on the same dc bus to delay the start.

P 2.6.1.2 Run Enable Input **No. 103**

Select an input for enabling the converter to run. Run Enable is a mandatory signal for the converter to run. If removed in the run state, then it will stop the converter and the converter will not go into run state without issuing this signal back.

P 2.6.1.3 Switch On Enable Input **No. 4728**

Select a digital input for enabling the converter to force open the main circuit breaker if the signal becomes low. The converter will not start if the Switch On Enable Input is low.

7.3.6.2 Quick Stop (Menu Index 2.6.2)

The purpose of quick stop is to stop the converter, regardless of the operation condition. A common use case for quick stop is to allow the converter to make a controlled stop when the Emergency Stop button is pressed. Usually, there are a few seconds to make a controlled stop before an emergency stop forces all breakers to open and makes the system electrically safe. In Grid Converter, modulation is stopped immediately and the MCB is opened.

P 2.6.2.1 Quick Stop Input **No. 212**

Select an input for the Quick Stop function. Quick Stop is activated when this input becomes FALSE. In addition to stopping the unit, Quick Stop will open the main circuit breaker (if controlled by the converter) irrespective of the selected response.

P 2.6.2.2 Quick Stop Input 2 **No. 5104**

Select an input for the Quick Stop function. Quick Stop is activated when this input becomes FALSE. In addition to stopping the unit, Quick Stop will open the main circuit breaker (if controlled by the converter) irrespective of the selected response.

P 2.6.2.3 Quick Stop Response **No. 4587**

Select the response to a Quick Stop event. Regardless of the selected response, in addition to stopping the unit, the Quick Stop function will open the main circuit breaker (if controlled by the converter).

The following are the selections for the parameter.

Number	Name	Description
0	No response	The event is ignored.
1	Info	The event is logged in the event log.
3	Warning	The drive issues a warning.
10	Fault	A fault is issued, and the modulation is stopped.
11	Fault, Open MCB	A fault is issued, the modulation is stopped and the MCB is opened, if controlled by the converter

7.3.6.3 Pre Charge (Menu Index 2.6.3)

P 2.6.3.1 Pre-Charge Request Output No. 6563

Set pre-charging command digital output.

P 2.6.3.2 Pre-Charge Ready Level No. 6566

Set the DC-link voltage level in % of nominal voltage above which the pre-charging becomes ready.

P 2.6.3.3 Pre Charge Request Inp. No. 6567

Set the digital input for starting the pre charge. This input will start the pre charge and the main circuit breaker will close based on the closing mode.

P 2.6.3.4 Pre-charge Allowed Output No. 6569

Set the digital output terminal for pre-charging allowed.

P 2.6.3.5 Pre-Charge Allowed Level No. 5510

Set the level (DC Voltage in % of the nominal dc voltage) below which precharge is allowed.

7.3.6.4 Main Circuit Breaker (Menu Index 2.6.4)

P 2.6.4.1 MCB Close Output No. 6551

Set the digital output for main circuit breaker closing. This is a state based output which can be used for digital output terminals.

P 2.6.4.2 MCB Feedback Close Input No. 6552

Set the digital input for main circuit breaker closing feedback.

P 2.6.4.3 MCB Feedback Open Input No. 6553

Set the digital input for main circuit breaker opening feedback.

P 2.6.4.4 MCB Tripped Input No. 6554

Set the digital input for main circuit breaker tripped feedback.

P 2.6.4.5 MCB Close Pulse Output No. 6555

Set the digital output for main circuit breaker closing pulse command. This is a pulse-based output and can be used for relay output terminals.

P 2.6.4.6 MCB Open Pulse Output No. 6556

Set the digital output for main circuit breaker opening pulse command. This is a pulse based output and can be used for relay output terminals.

P 2.6.4.7 MCB Close Enable Input No. 6557

Set the digital input for main circuit breaker closing enable. Main circuit breaker will not close without this signal. If removed in the run state, then it will open the main circuit breaker. The converter will not go into the run state without this signal.

P 2.6.4.8 MCB Feedback Fault Delay No. 6558

Delay in seconds after which the main circuit feedback fault becomes active when the feedback is missing.

P 2.6.4.9 MCB Closing Mode No. 6559

Set the main circuit breaker closing mode configuration if the breaker is configured to be closed by the application.

The following are the selections for the parameter.

Number	Name	Description
0	DC-link Pre Charge Ready	Main circuit breaker will close when the Pre-Charge Ready signal sees a rising edge. If the breaker is opened and the DC-link Pre-Charge Ready stays high, then it will require discharging of the DC-link and charging it back to allow the application to close the breaker.
1	Start Command	Main circuit breaker will only close on the start command. With this selection, the main circuit breaker is closed first and once the feedback of the breaker is true then the converter can start modulation.
2	DC-link Pre Charge Ready or Start Command	Either of selection 0 or 1 can close the main circuit breaker.
3	LCL Filter Energized	Main circuit breaker is closed only when the LCL filter is energized first. The energization will require a voltage measurement board behind the main circuit breaker connected and activated.

P 2.6.4.10 MCB Opening Mode No. 6560

Set the main circuit breaker opening mode if the breaker is configured to be opened by the application.

The following are the selections for the parameter.

Number	Name	Description
0	DC Voltage Level	Main circuit breaker will open once the DC-link voltage goes below the Pre-charge Ready Level.
1	Stop Command or DC Voltage Level	Main circuit breaker will only open either on stop command or when the DC-link voltage goes below the Pre-charge Ready Level.
2	Fault Active or DC Voltage Level	Main circuit breaker will open on any fault activation or when the DC-link voltage goes below the Pre-charge Ready Level.
3	Fault Active or Stop Command or DC	Main circuit breaker will open if any of the conditions from selections 0,1 or 2 are fulfilled.

7.3.6.5 LCL-Filter Energization (Menu Index 2.6.5)

P 2.6.5.1 Filter Voltage Ramp Time No. 5161

Set the ramp time (0 V to nominal grid voltage) for the filter voltage. The ramping is performed during LCL-filter energization when this is controlled by the converter.

P 2.6.5.2 Max. Filter Energization Time No. 5162

Set maximum allowed time for filter energization. Filter energization will fail and issue a fault if the energization is not completed before the maximum time elapsed from the start request.

7.3.7 Control Places (Menu Index 2.7)

The Grid Converter application features four different control places for determining how basic converter commands and references are interfaced. These control places are the MyDrive® Insight (PC Control), Local Control (via control panel), Fieldbus Control and I/O Control.

Selection:
There are two methods for selecting which control place is active, or in other words in command of the converter. The first is a simple parameter selection, while the second is a set of signals that can be used to force or request for a specific control place to be in command.

Commands:
A control place is a source for basic control commands (start, stop, reset, and so on). When operating for instance in I/O control, the converter cannot be started from the local or fieldbus control places. Control places do not dictate all possible commands. Note that specific features such as Quick Stop can be used regardless of the control place and must be configured separately.

Control Place Settings
This group contains general control place settings that mainly have to do with control place selection. The following figure presents the control place selection chain diagram. The default method for choosing the control place is by using the parameter No. 114 Control Place Selection. It can be used to select the active control place between Local, Fieldbus and I/O control.

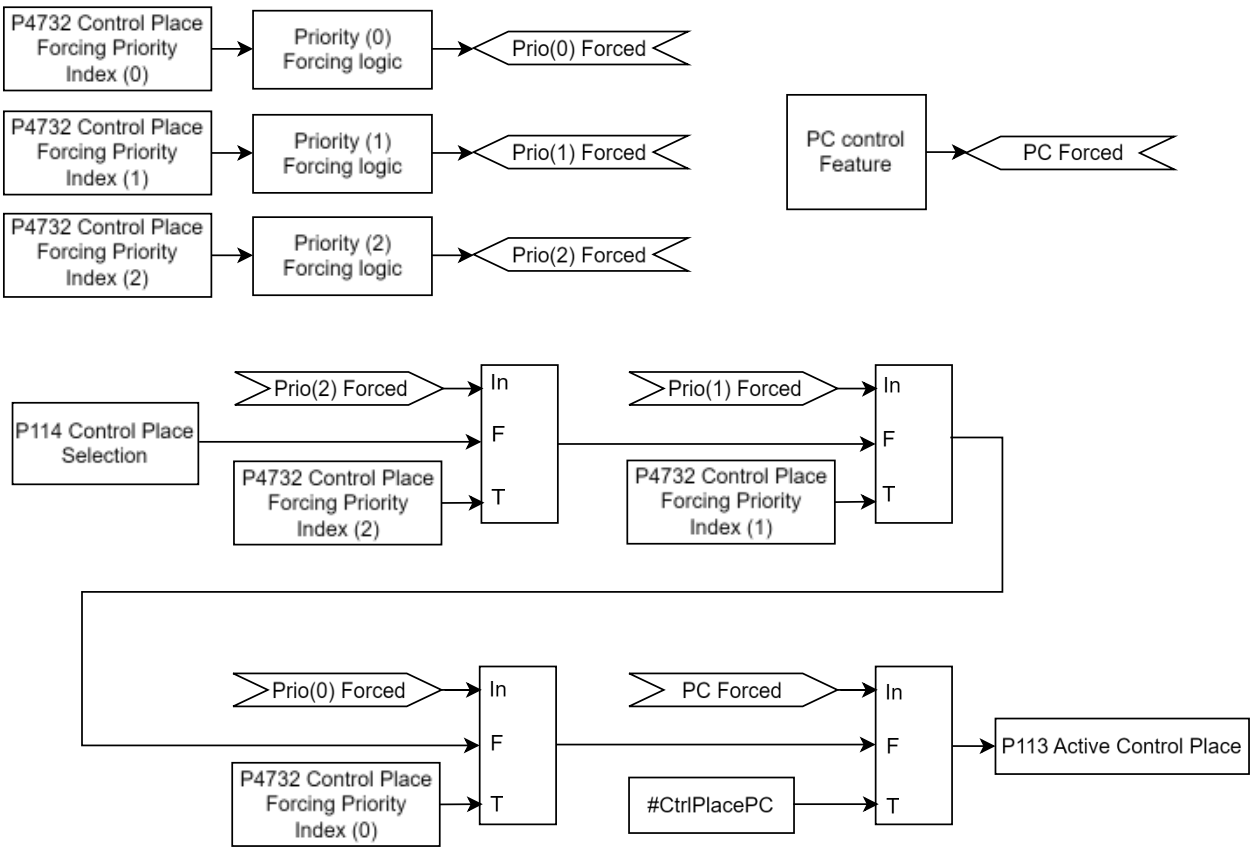


Figure 2: Control place selection chain diagram.

The second option for control place selection is to use control place forcing signals, which will override the selection made with the parameter, and can be used to swap between different control places, for example via external push buttons or switches. The forcing signals for Fieldbus and I/O control can be mapped to digital inputs or fieldbus, and the Local control forcing is activated with the REM/LOC button of the control panel.

The priority order for the forceable control places is configured with parameter No. 4732. The priority order affects the final control place selection if two or more control places are forced on simultaneously. For example: if Fieldbus is selected for highest priority with Index-0, and I/O for the next highest priority with index-1, and both control places are forced on simultaneously, fieldbus is selected as the active control place. After Fieldbus forcing is removed the control place will fall to I/O because it has higher priority than the parameter selection.

The only control place which can take over the control from any other control place regardless of forcing inputs is the MyDrive® Insight. Control is overtaken by requesting it via the tool itself. By default, the converter uses the following control place priority order:

MyDrive® Insight > Local Control > I/O > Fieldbus > Parameter Selection

Forcing can be further configured with parameter No. 1972 which defines whether each forcing signal is treated as a state sensitive or toggled signal.

Parameter No. 4800 can be used to define how the converter should behave when an active control place releases control. The options are to either release control immediately or only if another control place requests control.

When a control place is changed, the converter will either stop or continue operating (modulation) based on the settings defined with parameters No. 108, No. 5112, and No. 5111, respectively for each control place.

7.3.7.1 Control Place Settings (Menu Index 2.7.1)

P 2.7.1.1 Control Place Selection **No. 114**

Select the active control place.

The following are the selections for the parameter.

Number	Name
0	PC control
1	Local Control
2	Fieldbus control
3	I/O Control

P 2.7.1.2 Force FB Control Input **No. 4511**

Select an input for forcing the control place to Fieldbus.

P 2.7.1.3 Force I/O Control Input **No. 4513**

Select an input for forcing the control place to I/O.

P 2.7.1.4 Control Place Forcing Mode **No. 1972**

Select whether each control place forcing signal is treated as a state sensitive or a toggled signal.

The following are the selections for the parameter.

Number	Name
0	FB: State | I/O: State
1	FB: Toggle | I/O: State
2	FB: State | I/O: Toggle
3	FB: Toggle | I/O: Toggle

P 2.7.1.5 Control Place Independent Reset **No. 109**

Enable faults to be reset from all control places.

The following are the selections for the parameter.

Number	Name
0	Disabled
1	Enabled

P 2.7.1.6 Control Place Release Mode No. 4800

Select the action after the control place is released from the forced control places, as well as from control panel or PC control. When set to "Change After Release" the control place is changed after releasing to other forced place highest in priority order, or in case no forced places are used, to the place defined with parameter “Control Place Selection”. When set to "Retain After Release" the control place is not changed after releasing, but only after the control place is changed by forcing or from parameter “Control Place Selection”.

The following are the selections for the parameter.

Number	Name	Description
0	Retain After Release	Control place is retained after releasing.
1	Change After Release	Control place is changed after releasing.

P 2.7.1.7 Control Place Forcing Priority No. 4732

Set the control place priority when using control place forcing inputs. The priority is specified in decreasing order. Therefore, in case multiple control places are requested simultaneously, the selection made with Index 0 prevails on the selection made with Index 1, and so on. If a control place is not assigned any priority, its forcing signal is disabled.

The following are the selections for the parameter.

Number	Name
0	PC control
1	Local Control
2	Fieldbus control
3	I/O Control

7.3.7.2 Local Control (Menu Index 2.7.2)

P 2.7.2.1 Local Control Mode No. 107

Select restrictions of local control by the control panel.

The following are the selections for the parameter.

Number	Name	Description
0	Allow Local Control	Local mode from control panel is enabled.
1	Deny Local Start	Start in local mode from control panel is disabled.
2	Deny Local Control	Local mode from control panel is disabled.

P 2.7.2.2 Continue Operation in Local Control No. 108

Select whether the start request is retained when the converter is running, and the control place is changed to local control.

The following are the selections for the parameter.

Number	Name
0	Disabled
1	Enabled

7.3.7.3 I/O Control (Menu Index 2.7.3)

P 2.7.3.1 I/O Start Input No. 200

Select an input for starting the unit when the active control place is I/O Control.

P 2.7.3.2 I/O Stop Input No. 201

Select an input for stopping the unit when the active control place is I/O Control. Stop is activated when this input becomes FALSE.

P 2.7.3.3 I/O Reset Input No. 203

Select an input for the warning/fault reset when the active control place is I/O Control. The dependence on control place is selected based on Control Place Independent Reset (No. 109).

P 2.7.3.4 I/O Start Mode No. 213

Select whether start commands for I/O control are state, rising edge or pulse sensitive.

The following are the selections for the parameter.

Number	Name	Description
0	State High Start	Start command remains as long as input is true.
1	Rising Edge Start	Start command is set when input becomes true and remains latched until stop command is given or input becomes false. Start command does not remain latched over a stop, even if start input is kept true.
2	High Pulse Start	Start command is set when input becomes true and remains latched until stop command is given.

P 2.7.3.5 Continue Operation in I/O Control No. 5111

Description: Select whether the start request is retained when the drive is running and the control place is changed to I/O, while using edge-sensitive start modes. Note that any active stop command or auxiliary function such as quick stop may still prohibit continuing operation.

The following are the selections for the parameter.

Number	Name
0	Disabled
1	Enabled

7.3.7.4 Fieldbus Control (Menu Index 2.7.4)

P 2.7.4.1 Continue Operation in Fieldbus Control No. 5112

Select whether the start request is retained when the drive is running and the control place is changed to fieldbus. Note that any active stop command or auxiliary function such as quick stop may still prohibit continuing operation. Note also that continuation is possible only if the start is requested from fieldbus before the control place is changed to it.

The following are the selections for the parameter.

Number	Name
0	Disabled
1	Enabled

P 2.7.4.2 Fieldbus Start Mode No. 5114

Select whether start commands for Fieldbus Control are state or rising-edge sensitive.

The following are the selections for the parameter.

Number	Name	Description
0	State High Start	Start command remains as long as input is true.
1	Rising Edge Start	Start command is set when input becomes true and remains latched until stop command is given or input becomes false. Start command does not remain latched over a stop, even if start input is kept true.

7.3.8 Converter Control (Menu Index 2.8)

7.3.8.1 Modulation (Menu Index 2.8.1)

This group contains parameters for fine-tuning modulation settings.

P 2.8.1.1 Switching Frequency **No. 2920**

Set the switching frequency. Note that the actual switching frequency is regulated by the converter itself, and it may be derated by some protections function.

P 2.8.1.2 Modulator Options **No. 5093**

Advanced modulator options.

The following are the selections for the parameter.

Number	Name
0	Disable compensation of non-linearities.
1	Disable deadtime compensation based on feedback.
2	Use filtered DC voltage over whole speed range.
3	Prohibit pulse dropping when reaching voltage ceiling.
4	Optimized minimum pulse logic for carrier synchronization.

P 2.8.1.3 Modulator Type **No. 5100**

Select the modulator type.

The following are the selections for the parameter.

Number	Name	
1	SVPWM	Standard Space Vector Pulse Width Modulation. Use in special applications, where automatic change of PWM carrier frequency and modulation pattern might cause issues Drive derating is required.
4	CMRPWM	The CMR modulator optimizes the common-mode voltage waveform. Can be useful with certain drive configurations to minimize motor or generator voltage spikes. The modulator does not support independent paralleling. If paralleling sync. is enabled (with param No. 9654) the modulator type is internally forced to Grid Converter. Recommended selection for Active Front-End drives.
5	Grid Converter	The modulator optimizes the trade-off between losses and harmonics. Recommended selection for most power conversion applications. Modulation parameters are automatically set.

P 2.8.1.4 Forward Voltage Compensation **No. 6518**

Forward voltage drop of the converter. Value is proportional to hard-coded default value.

7.3.8.2 Advanced Grid Control (Menu Index 2.8.2)

WARNING

Advanced Grid Control parameters must not be changed without consulting Danfoss Drives Service personnel.

P 2.8.2.1 Active Current Kp **No. 2868**

Set scaling of internally computed active current controller proportional gain.

P 2.8.2.2 Active Current Ti **No. 2869**

Set scaling of internally computed active current controller integral time.

P 2.8.2.3 Grid PLL Tc **No. 9659**

Time constant defining the bandwidth of the grid synchronization PLL.

P 2.8.2.4 Active Damping Kp **No. 2871**

Scaling of internally computed active damping gain used to control LCL filter resonance.

P 2.8.2.5 Reactive Current Kp **No. 2849**

Scaling of internally computed reactive current controller proportional gain.

P 2.8.2.6 Reactive Current Ti **No.2850**

Scaling of internally computed reactive current controller integral time.

P 2.8.2.7 Grid Control Options **No. 9658**

Shows the Grid Control Options Word. B0: Disable observer in control B1: Enable LCL filter pre charge B2: Enable feedforward term.

P 2.8.2.8 Paralleling Sync. Run Kp **No. 9655**

Proportional gain of the PWM carrier synchronization control in run state.

P 2.8.2.9 Paralleling Sync. Stop Kp **No. 9656**

Proportional gain of the PWM carrier synchronization control in stop state.

P 2.8.2.10 Paralleling Sync. Shift Kp **No. 9657**

Proportional gain of the common mode current control.

P 2.8.2.11 Power Factor Sign Mode **No. 5098**

Defines the sign convention of power factor. 0 = Active power defines sign of Power Factor readout (IEC convention). 1 = Reactive power defines sign of Power Factor readout (IEEE convention). Default setting depends on Converter Mode with 0 (IEC) for motor control and 1 (IEEE) for grid control.

The following are the selections for the parameter.

Number	Name
0	IEC Convention
1	IEEE Convention

P 2.8.2.12 Ac Voltage Control Kp **No. 6510**

Scaling of internally computed AC voltage control proportional gain.

P 2.8.2.13 Ac Voltage Control Ti **No. 6511**

Scaling of internally computed AC voltage control integral time.

P 2.8.2.14 PQ Mode Active Current Ctrl. Kp **No. 6512**

PQ control active current controller gain in Hz/GridNomCurrent.

P 2.8.2.15 PQ Mode Active Current Ctrl. Ti **No. 6513**

PQ control active current controller integration time.

P 2.8.2.16 PQ Mode Reactive Current Ctrl Ki **No. 6514**

PQ control reactive current controller integration gain in Pct.

P 2.8.2.17 Virtual Impedance **No. 6515**

Dynamic virtual impedance of microgrid converter output.

P 2.8.2.18 Virtual Impedance Tc **No. 6516**

Time constant of dynamic virtual impedance.

P 2.8.2.19 Virtual Impedance Filt. Tc **No. 6517**

Time constant of low filtering of current used by virtual impedance.

P 2.8.2.20 Harmonic Current Control Gain **No. 6519**

Description: Integrator gain of the Harmonic current control.

P 2.8.2.21 Short Term Current Options **No. 2918**

B0=Deactivation when grid voltage is nominal and power is high from grid to DC-link.

P 2.8.2.22 Neg. Seq. Current Control Kp **No. 6500**

Set negative sequence current control proportional gain.

P 2.8.2.23 Neg. Seq. Current Control Ti **No. 6501**

Set negative sequence current control integration time.

P 2.8.2.24 Neg. Seq. Voltage Control Kp **No. 6502**

Set negative sequence voltage control proportional gain.

P 2.8.2.25 Neg. Seq. Voltage Control Ti **No. 6503**

Set negative sequence voltage control integration time.

P 2.8.2.26 Harmonic Voltage Control Gain **No. 4999**

Set the value of gain for voltage harmonic resonant control.

7.3.8.3 Advanced DC-link Control (Menu Index 2.8.3)

WARNING

Advanced DC-link Control parameters must not be changed without consulting Danfoss Drives Service personnel.

P 2.8.3.1 DC-link Voltage Ctrl. Kp **No. 2902**

Scaling of internally computed DC-link voltage control proportional gain.

P 2.8.3.2 DC-link Voltage Ctrl. Ti **No. 2903**

Scaling of internally computed DC-link voltage control integral time.

P 2.8.3.3 DC-link Voltage Ctrl. Td **No. 2907**

Scaling of internally computed DC-link voltage control differential time.

P 2.8.3.4 DC-link Voltage Droop. Tc **No. 5095**

Filtering time constant of active current when DC-link voltage drooping is used.

P 2.8.3.8 Overvoltage Control Kp **No. 1803**

Set the scaling of the overvoltage control proportional gain.

P 2.8.3.9 Overvoltage Control Ti **No. 1804**

Set the scaling of the overvoltage control integral time.

P 2.8.3.10 Overvoltage Control Td **No. 1805**

Set the scaling of the overvoltage control derivation time.

P 2.8.3.11 Undervoltage Control Kp **No. 1806**

Set the scaling of the undervoltage control proportional gain.

P 2.8.3.12 Undervoltage Control Ti **No. 1807**

Set the scaling of the undervoltage control integral time.

P 2.8.3.13 Undervoltage Control Td **No. 1808**

Set the scaling of the undervoltage control derivation time.

7.3.8.4 Power Unit Settings (Menu Index 2.8.4)

P 2.8.4.1 Power Unit Enable Mask **No. 2835**

Select which of the commissioned power units are enabled.

The value is given bitwise per each unit. Bit 0 corresponds to the first port in the Star coupler board, and bit 15 to the 16th port and so on. An active bit enables the corresponding power unit, and an inactive bit disables it.

This parameter is relevant only for drives with multiple power units, connected to the control board with the Star coupler board. Faulty or redundant power units can be disabled temporarily to allow running with reduced capacity. All internal protection functions adjust to the amount of enabled power units.

WARNING

Depending on the system's hardware configuration, it might be necessary to galvanically isolate the disabled units and all associated filters from the system. Failing to do so may increase the risk of resonance and damage the rest of the system. Contact Danfoss technical support for further instructions before using this functionality.

NOTICE

This parameter cannot be edited when the converter is running.

NOTICE

After Factory Reset or Node Commissioning the drive will automatically set this parameter to activate the nominal number of power units starting sequentially from the first port of the Star coupler board. If the drive has several power units, but this parameter does not have the correct value at initial start, it is recommended to run Factory Reset and power-cycle the drive. This operation will reset the Power Unit Enable Mask to correspond with the nominal amount of power units.

P 2.8.4.2 DC-link Voltage Measurement Corr. Gain **No. 6535**

Set the DC-link voltage measurement correction gain for parallel units.

P 2.8.4.3 DC-link Voltage Measurement Corr. Offset **No. 6534**

Set the DC-link voltage measurement correction offset for parallel units.

P 2.8.4.4 HF DC-link Filter Mode **No. 2944**

Select the mode of the high-frequency filter in the DC link.

The following are the selections for the parameter.

Number	Name
0	Filter inactive
1	Filter active

7.3.8.5 Cooling Fan Control (Menu Index 2.8.5)

Cooling fan control is only possible for the air cooled converters.

P 2.8.5.1 Main Fan Minimum Speed No. 2932

Set the minimum speed of the main cooling fan.

P 2.8.5.2 Internal Fan Minimum Speed No. 2928

Set the minimum speed of the internal cooling fan.

7.3.8.6 LCL-Filter (Menu Index 2.8.6)

P 2.8.6.1 LCL Filter L1 No. 2904

Set the converter side filter inductance.

P 2.8.6.2 LCL Filter Cf No. 2905

Set the filter capacitance.

P 2.8.6.3 LCL Filter L2 No. 2906

Set the grid side filter inductance.

7.3.9 Protections and Responses (Menu Index 2.9)

7.3.9.1 General Settings (Menu Index 2.9.1)

P 2.9.1.1 Retry after Fault No. 2927

Enables retry functionality (ride-through) functionality for the following fault type events. The number of retry attempts and the retry window depend on the event and the size and rating of the power unit.

The following are the selections for the parameter.

Number	Name
0	Disabled
1	Enabled

P 2.9.1.2 Active Current Limit Warn. Preset No. 5131

Set the (absolute) value the active current limits are ramped to when an event is active for which 'Warning, Current Lim. Ramp' is selected as a response. It is expressed in % of the grid nominal current.

P 2.9.1.3 Active Current Limit Warn. Ramp Rate No. 5130

Set the slope (absolute value) of the pos./neg. active current limit ramps which are performed when an event for which 'Warning, Current Lim. Ramp' is selected as a response is active. It is expressed in % of the grid nominal current per second. When set to -1, no ramp is performed.

7.3.9.2 Misc. Responses (Menu Index 2.9.2)

P 2.9.2.1 DC-link Voltage Ripple Response **No. 2929**

Select the mode of excessive DC-link voltage ripple protection. Excessive voltage ripples are detected when the peak-to-peak amplitude of the DC voltage exceeds the converter's internal limit for too long a time. Both the limit and time depend on the power unit type and rating.

The following are the selections for the parameter.

Number	Name	Description
0	Disabled	Effectively nothing is done when excessive rippling is detected.
1	Fault	After detecting excessive ripples for too long, the converter will issue a fault and stop modulation.
2	Automatically derate + Fault	After detecting excessive ripples, the converter will derate the maximum allowed output frequency. If the derating does not reduce the rippling soon enough, the converter will issue a fault and stop modulation. The derating is released if the ripple amplitude is reduced below the detection limit.

P 2.9.2.2 LCL Fan Fail Response **No. 2941**

Select the drive response to an LCL Fan Fail.

The following are the selections for the parameter.

Number	Name	Description
0	No response	-
1	Info	The converter will issue an info event.
3	Warning	The converter will issue a warning event.
10	Fault	The converter will issue a fault event and stop modulation.
11	Fault, Open MCB	The converter will issue a fault event, stop modulation, and open the main circuit breaker.

7.3.9.3 External Event (Menu Index 2.9.3)

External events are protection functions which can be configured to trigger converter events (warnings, faults, and so on) through inputs. Two separate events are available, both can be triggered with an active-high or active-low signals.

P2.9.3.1 External Event 1 Input No. 4557

Select an input for the external event.

P2.9.3.3 External Event 1 Response No. 4559

Select the response to an external event.

Number	Name	Description
0	No response	-
1	Info	The converter will issue an info event.
3	Warning	The converter will issue a warning event.
10	Fault	The converter will issue a fault event and stop modulation.
11	Fault, Open MCB	The converter will issue a fault event, stop modulation, and open the main circuit breaker.

P2.9.3.3 External Event 2 Input No. 4560

Select an input for the external event.

P2.9.3.4 External Event 2 Response No. 4562

Select the response to an external event.

Number	Name	Description
0	No response	-
1	Info	The converter will issue an info event.
3	Warning	The converter will issue a warning event.
10	Fault	The converter will issue a fault event and stop modulation.
11	Fault, Open MCB	The converter will issue a fault event, stop modulation, and open the main circuit breaker.

7.3.9.4 Cooling Monitor (Menu Index 2.9.4)

The cooling monitor feature is relative for liquid cooled converters. It is designed to allow the converter to receive a single digital signal from the cooling unit when it experiences errors. The converter will then act as configured.

P2.9.4.1 Cooling Monitor Input No. 2400

Select the input for the negated cooling monitor signal.

P2.9.4.2 Cooling Monitor Fault Delay No. 2401

Set a delay before the cooling monitor issues a fault. Only valid if fault is selected.

P2.9.4.3 Cooling Monitor Response No. 2402

Select the response to a missing cooling monitor signal. The response is selected for both stopped and running states.

Number	Name	Description
0	Warning while running	The converter issues a warning if the cooling signal is lost, and the converter is running.
1	Warning	The converter issues a warning if the cooling signal is lost.
2	Warning, Fault after Timeout while running	The converter issues a warning if the cooling signal is lost. If the converter is running the event is escalated into a fault after the fault delay (No. 2401).
3	Warning and Fault after Timeout while running	The converter issues a warning if the cooling signal is lost, and the converter is running. After the fault delay (No. 2401) the event is escalated into a fault.

7.3.9.5 Measured Temp. Protection

The measured temperature protection offers 10 individual protection channels for monitoring temperatures of external devices like filters or motor windings through temperature probes. Each protection can be configured to trigger an individual event, which can be used to identify the source of the high temperature measurement.

Each protection has two configurable stages, as illustrated in the following figure. Stage 1 is used to trigger a warning, while stage 2 can be used to trigger a more severe event (fault), which may possibly stop the converter. The activation levels of both stages and the event response of stage 2 are configurable. The levels of both stages can be configured to be the same, if two stages are unnecessary.

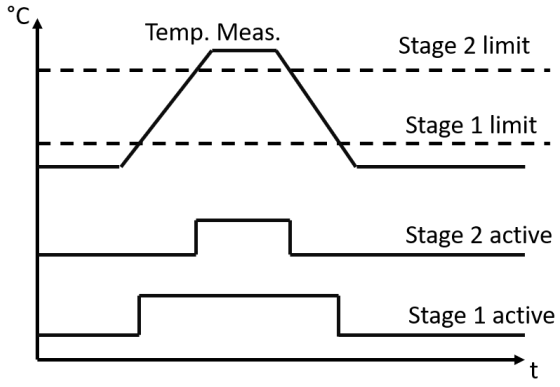


Figure 3: Operation principle of temperature measurement protection function.

Additionally, a temperature measurement range check feature is also available, as presented in the following figure. A range can be defined for checking the validity of each measured temperature protection. If the absolute measurement value of any protection exceeds this range, a separate event can be triggered.

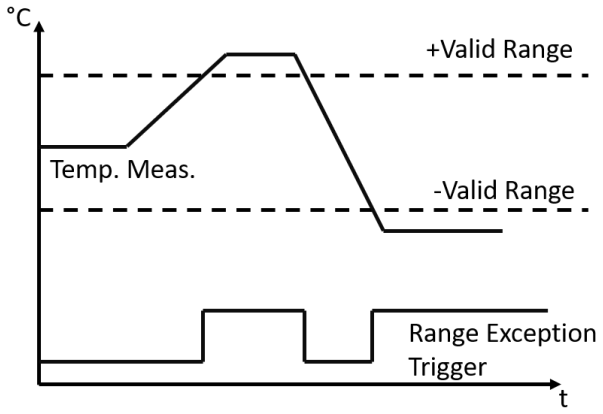


Figure 4: Operation principle of temperature measurement range check.

7.3.9.5.1 Temp. 1 Protection

P2.9.5.1.1 Temp. 1 Input No. 5206
Select the temperature sensor input for the temperature protection.

P2.9.5.1.2 Temp. 1 Limit 1 No. 5207
Set the temperature level for issuing a warning.

P2.9.5.1.3 Temp. 1 Limit 2 No. 5208
Set the temperature level for issuing a protection response.

P2.9.5.1.4 Temp. 1 Limit 2 Response No. 5209
Select the response for exceeding the limit.

Number	Name	Description
0	No response	-
1	Info	The converter will issue an info event.
3	Warning	The converter will issue a warning event.
10	Fault	The converter will issue a fault event and stop modulation.
11	Fault, Open MCB	The converter will issue a fault event, stop modulation, and open the main circuit breaker.

7.3.9.5.2 Temp. 2 Protection

P2.9.5.2.1 Temp. 2 Input No. 5210
Select the temperature sensor input for the temperature protection.

P2.9.5.2.2 Temp. 2 Limit 1 No. 5211
Set the temperature level for issuing a warning.

P2.9.5.2.3 Temp. 2 Limit 2 No. 5212
Set the temperature level for issuing a protection response.

P2.9.5.2.4 Temp. 2 Limit 2 Response No. 5213
Select the response for exceeding the limit.

Number	Name	Description
0	No response	-
1	Info	The converter will issue an info event.
3	Warning	The converter will issue a warning event.
10	Fault	The converter will issue a fault event and stop modulation.
11	Fault, Open MCB	The converter will issue a fault event, stop modulation, and open the main circuit breaker.

7.3.9.5.3 Temp. 3 Protection

P2.9.5.3.1 Temp. 3 Input No. 5214
Select the temperature sensor input for the temperature protection.

P2.9.5.3.2 Temp. 3 Limit 1 No. 5215
Set the temperature level for issuing a warning.

Number	Name	Description
0	No response	-
1	Info	The converter will issue an info event.
3	Warning	The converter will issue a warning event.
10	Fault	The converter will issue a fault event and stop modulation.
11	Fault, Open MCB	The converter will issue a fault event, stop modulation, and open the main circuit breaker.

P2.9.5.3.3 Temp. 3 Limit 2 No. 5216
Set the temperature level for issuing a protection response.

P2.9.5.3.4 Temp. 3 Limit 2 Response No. 5217
Select the response for exceeding the limit.

Number	Name	Description
0	No response	-
1	Info	The converter will issue an info event.
3	Warning	The converter will issue a warning event.
10	Fault	The converter will issue a fault event and stop modulation.
11	Fault, Open MCB	The converter will issue a fault event, stop modulation, and open the main circuit breaker.

7.3.9.5.4 Temp. 4 Protection

P2.9.5.4.1 Temp. 4 Input No. 5218
Select the temperature sensor input for the temperature protection.

P2.9.5.4.2 Temp. 4 Limit 1 No. 5219

Set the temperature level for issuing a warning.

P2.9.5.4.3 Temp. 4 Limit 2 No. 5220
Set the temperature level for issuing a protection response.

P2.9.5.4.4 Temp. 4 Limit 2 Response No. 5221
Select the response for exceeding the limit.

Number	Name	Description
0	No response	-
1	Info	The converter will issue an info event.
3	Warning	The converter will issue a warning event.
10	Fault	The converter will issue a fault event and stop modulation.
11	Fault, Open MCB	The converter will issue a fault event, stop modulation, and open the main circuit breaker.

7.3.9.5.5 Temp. 5 Protection

P2.9.5.5.1 Temp. 5 Input No. 5222
Select the temperature sensor input for the temperature protection.

P2.9.5.5.2 Temp. 5 Limit 1 No. 5223
Set the temperature level for issuing a warning.

P2.9.5.5.3 Temp. 5 Limit 2 No. 5224
Set the temperature level for issuing a protection response.

P2.9.5.5.4 Temp. 5 Limit 2 Response No. 5225
Select the response for exceeding the limit.

Number	Name	Description
0	No response	-
1	Info	The converter will issue an info event.
3	Warning	The converter will issue a warning event.
10	Fault	The converter will issue a fault event and stop modulation.
11	Fault, Open MCB	The converter will issue a fault event, stop modulation, and open the main circuit breaker.

7.3.9.5.6 Temp. 6 Protection

P2.9.5.6.1 Temp. 6 Input No. 5226
Select the temperature sensor input for the temperature protection.

P2.9.5.6.2 Temp. 6 Limit 1 No. 5227
Set the temperature level for issuing a warning.

P2.9.5.6.3 Temp. 6 Limit 2 No. 5228
Set the temperature level for issuing a protection response.

P2.9.5.6.4 Temp. 6 Limit 2 Response No. 5229

Select the response for exceeding the limit.

Number	Name	Description
0	No response	-
1	Info	The converter will issue an info event.
3	Warning	The converter will issue a warning event.
10	Fault	The converter will issue a fault event and stop modulation.
11	Fault, Open MCB	The converter will issue a fault event, stop modulation, and open the main circuit breaker.

7.3.9.5.7 Temp. 7 Protection

P2.9.5.7.1 Temp. 7 Input No. 5239
Select the temperature sensor input for the temperature protection.

P2.9.5.7.2 Temp. 7 Limit 1 No. 5243
Set the temperature level for issuing a warning.

P2.9.5.7.3 Temp. 7 Limit 2 No. 5269
Set the temperature level for issuing a protection response.

P2.9.5.7.4 Temp. 7 Limit 2 Response No. 5235
Select the response for exceeding the limit.

Number	Name	Description
0	No response	-
1	Info	The converter will issue an info event.
3	Warning	The converter will issue a warning event.
10	Fault	The converter will issue a fault event and stop modulation.
11	Fault, Open MCB	The converter will issue a fault event, stop modulation, and open the main circuit breaker.

7.3.9.5.8 Temp. 8 Protection

P2.9.5.8.1 Temp. 8 Input No. 5240
Select the temperature sensor input for the temperature protection.

P2.9.5.8.2 Temp. 8 Limit 1 No. 5247
Set the temperature level for issuing a warning.

P2.9.5.8.3 Temp. 8 Limit 2 No. 5270
Set the temperature level for issuing a protection response.

P2.9.5.8.4 Temp. 8 Limit 2 Response No. 5236
Select the response for exceeding the limit.

Number	Name	Description
0	No response	-
1	Info	The converter will issue an info event.
3	Warning	The converter will issue a warning event.

Number	Name	Description
10	Fault	The converter will issue a fault event and stop modulation.
11	Fault, Open MCB	The converter will issue a fault event, stop modulation, and open the main circuit breaker.

7.3.9.5.9 Temp. 9 Protection

P2.9.5.9.1 Temp. 9 Input No. 5241
Select the temperature sensor input for the temperature protection.

P2.9.5.9.2 Temp. 9 Limit 1 No. 5249
Set the temperature level for issuing a warning.

P2.9.5.9.3 Temp. 9 Limit 2 No. 5271
Set the temperature level for issuing a protection response.

P2.9.5.9.4 Temp. 9 Limit 2 Response No. 5237
Select the response for exceeding the limit.

Number	Name	Description
0	No response	-
1	Info	The converter will issue an info event.
3	Warning	The converter will issue a warning event.
10	Fault	The converter will issue a fault event and stop modulation.
11	Fault, Open MCB	The converter will issue a fault event, stop modulation, and open the main circuit breaker.

7.3.9.5.10 Temp. 10 Protection

P2.9.5.10.1 Temp. 10 Input No. 5242
Select the temperature sensor input for the temperature protection.

P2.9.5.10.2 Temp. 10 Limit 1 No. 5268
Set the temperature level for issuing a warning.

P2.9.5.10.3 Temp. 10 Limit 2 No. 5272
Set the temperature level for issuing a protection response.

P2.9.5.10.4 Temp. 10 Limit 2 Response No. 5238
Select the response for exceeding the limit.

Number	Name	Description
0	No response	-
1	Info	The converter will issue an info event.
3	Warning	The converter will issue a warning event.
10	Fault	The converter will issue a fault event and stop modulation.
11	Fault, Open MCB	The converter will issue a fault event, stop modulation, and open the main circuit breaker.

7.3.9.5.11 Common

P2.9.5.11.1 Meas. Valid Range No. 5230
Set a valid reading range for the temperature probe measurements. The first element of the array is the higher and the second element the lower limit. An event is triggered if 1 of the readings goes above the higher, or below the lower limit.

P2.9.5.11.2 Meas. Out of Range Response No. 5231
Select the converter response when 1 or more of the probes exceed the valid range.

Number	Name	Description
0	No response	-
1	Info	The converter will issue an info event.
3	Warning	The converter will issue a warning event.
10	Fault	The converter will issue a fault event and stop modulation.
11	Fault, Open MCB	The converter will issue a fault event, stop modulation, and open the main circuit breaker.

7.3.9.6 Thermistor Monitoring

The thermistor monitoring function provides three input channels that can be connected to a Positive Temperature Coefficient (PTC) type sensor. After a threshold of 4 kilo-ohms is exceeded in the input, an event is triggered. The event response is configurable.

P2.9.6.1 Thermistor Monitoring Response No. 5232
Select the response to all thermistor monitoring events.

Number	Name	Description
0	No response	-
1	Info	The converter will issue an info event.
3	Warning	The converter will issue a warning event.
10	Fault	The converter will issue a fault event and stop modulation.
11	Fault, Open MCB	The converter will issue a fault event, stop modulation, and open the main circuit breaker.

P2.9.6.2 Thermistor Monitor 1 Input No. 1520

Select a thermistor input for the thermistor monitor 1.

Number	Name	Description
0	None (False)	No input is selected. A virtual value of FALSE is applied.
1	None (True)	No input is selected. A virtual value of TRUE is applied.
*	Available thermistor input terminals	A dynamically generated selection of available thermistor input terminals is presented as an option. The specific set depends on the type and number of I/O options installed in the system.

P2.9.6.3 Thermistor Monitor 2 Input No. 1522

Select a thermistor input for the thermistor monitor 2.

Number	Name	Description
0	None (False)	No input is selected. A virtual value of FALSE is applied.
1	None (True)	No input is selected. A virtual value of TRUE is applied.
*	Available thermistor input terminals	A dynamically generated selection of available thermistor input terminals is presented as an option. The specific set depends on the type and number of I/O options installed in the system.

P2.9.6.4 Thermistor Monitor 3 Input No. 1524

Select a thermistor input for the thermistor monitor 3.

Number	Name	Description
0	None (False)	No input is selected. A virtual value of FALSE is applied.
1	None (True)	No input is selected. A virtual value of TRUE is applied.
*	Available thermistor input terminals	A dynamically generated selection of available thermistor input terminals is presented as an option. The specific set depends on the type and number of I/O options installed in the system.

7.3.9.7 Live Zero (Menu Index 2.9.7)

P 2.9.7.1 Live Zero Response

This parameter is used for selecting the converter generic behavior if at least one of the analog inputs has gone below the configurable threshold value.

Select the drive response to a missing input signal (live zero).
The following are the selections for the parameter.

Number	Name	Description
0	No response	The event is ignored.
1	Info	The event is logged in the event log.
3	Warning	The drive issues a warning.
13	Warning, Current Lim. Ramp - Persistent	A warning is issued and the pos./neg. active current limits are ramped to preset values. The current limit overrides stay active until the warning is acknowledged by a reset.
10	Fault	A fault is issued and the modulation is stopped.
11	Fault, Open MCB	A fault is issued, the modulation is stopped and the MCB is opened, if controlled by the converter.

7.3.9.8 Fieldbus Protections (Menu Index 2.9.8)

This group contains parameters for setting responses, delays, and other settings for fieldbus related protections.

P 2.9.8.1 Fieldbus Fault Response

Select the behavior when a fieldbus fault occurs.

The following are the selections for the parameter.

Number	Name	Description
0	No response	The event is ignored.
1	Info	The event is logged in the event log.
3	Warning	The drive issues a warning.
13	Warning, Current Lim. Ramp - Persistent	A warning is issued and the pos./neg. active current limits are ramped to preset values. The current limit overrides stay active until the warning is acknowledged by a reset.
10	Fault	A fault is issued and the modulation is stopped.
11	Fault, Open MCB	A fault is issued, the modulation is stopped and the MCB is opened, if controlled by the converter.

P 2.9.8.2 No Fieldbus Connection Response

Select the response in case there is no fieldbus connection.
The following are the selections for the parameter.

Number	Name	Description
0	No response	The event is ignored.
1	Info	The event is logged in the event log.
3	Warning	The drive issues a warning.
13	Warning, Current Lim. Ramp - Persistent	A warning is issued and the pos./neg. active current limits are ramped to preset values. The current limit overrides stay active until the warning is acknowledged by a reset.
10	Fault	A fault is issued and the modulation is stopped.
11	Fault, Open MCB	A fault is issued, the modulation is stopped and the MCB is opened, if controlled by the converter.

P 2.9.8.3 Process Data Timeout Response

Select the response to a process data timeout.
The following are the selections for the parameter.

Number	Name	Description
0	No response	The event is ignored.
1	Info	The event is logged in the event log.
3	Warning	The drive issues a warning.
13	Warning, Current Lim. Ramp - Persistent	A warning is issued and the pos./neg. active current limits are ramped to preset values. The current limit overrides stay active until the warning is acknowledged by a reset.
10	Fault	A fault is issued and the modulation is stopped.
11	Fault, Open MCB	A fault is issued, the modulation is stopped and the MCB is opened, if controlled by the converter.

P 2.9.8.4 Process Data Timeout Delay

Set a delay for the triggering of the Process Data Timeout event. If process data hasn't been updated within this delay time the event is triggered.

P 2.9.8.5 Fieldbus Watchdog Response

Select the drive response for the fieldbus watchdog event.

The following are the selections for the parameter.

Number	Name	Description
0	No response	The event is ignored.
1	Info	The event is logged in the event log.
3	Warning	The drive issues a warning.
13	Warning, Current Lim. Ramp - Persistent	A warning is issued and the pos./neg. active current limits are ramped to preset values. The current limit overrides stay active until the warning is acknowledged by a reset.
10	Fault	A fault is issued and the modulation is stopped.
11	Fault, Open MCB	A fault is issued, the modulation is stopped and the MCB is opened, if controlled by the converter.

P 2.9.8.6 Fieldbus Watchdog Delay

Set a delay for activating the fieldbus watchdog event.

P 2.9.8.7 Fieldbus Watchdog Start Delay

Set start-up delay time for activating the fieldbus watchdog event. Counter begins when converter wakes up.

7.3.9.9 HMI Connection Loss (Menu Index 2.9.9)

Selects the converter response for losing connection to MyDrive® Insight or the control panel while they are in control of the converter. Regardless of the response, the control is released to the control place with the next highest control priority.

P2.9.8.1 HMI Connection Loss No. 5420

Select the response after lost connection to control panel or PC tool while they are in control. The timeout occurs after 5 s.

The following are the selections for the parameter.

Number	Name	Description
0	No response	The event is ignored.
2	Info	The event is logged in the event log.
4	Warning - Persistent	The drive issues a warning that stays active until acknowledged by a reset.
10	Fault	A fault is issued and the modulation is stopped.
11	Fault, Open MCB	A fault is issued, the modulation is stopped and the MCB is opened, if controlled by the converter.

7.3.9.10 Cooling Fan Supervision (Menu Index 2.9.10)

P 2.9.10.1 Main Fan Fail Response No. 2939

Select the drive response to a main fan fail.

The following are the selections for the parameter.

Number	Name	Description
0	No response	The event is ignored.
1	Info	The event is logged in the event log.
3	Warning	The drive issues a warning.
10	Fault	A fault is issued, and the modulation is stopped.
11	Fault, Open MCB	A fault is issued, the modulation is stopped and the MCB is opened, if controlled by the converter.

P 2.9.10.2 Internal Fan Fail Response No.2940

Select the drive response to an internal fan fail.

The following are the selections for the parameter.

Number	Name	Description
0	No response	The event is ignored.
1	Info	The event is logged in the event log.
3	Warning	The drive issues a warning.
10	Fault	A fault is issued, and the modulation is stopped.
11	Fault, Open MCB	A fault is issued, the modulation is stopped and the MCB is opened, if controlled by the converter.

7.3.9.11 Limit Supervision (Menu Index 2.9.11)

Limit Supervision feature can be used to monitor current or power readouts.

If the supervised value becomes lower or higher than the *Limit Supervision 1 Threshold (No. 5253)*, it triggers the Limit Supervision fault, and the grid converter stops modulating if it is in run state. This protection also opens the main circuit breaker if controlled by the application and brings the DC- link voltage down to 0V.

The fault remains active as long as the supervised value is lower than *Limit Supervision 1 Threshold* when monitoring a low limit or higher than *Limit Supervision 1 Threshold* when monitoring a high limit.

P 2.9.11.1 Limit Supervision 1 Sel. No. 1990

Select the supervision value.

The following are the selections for the parameter.

Number	Name	Description
0	DC-link Current %	Shows the actual DC-link current in % of the DC-link nominal current.
1	DC-link Power %	Shows the actual DC-link power in % of the grid nominal power
2	Grid Active Current %	Shows the active current in % of grid nominal current.
3	Grid Active Power %	Shows the grid active power in % of grid nominal power.

P 2.9.11.2 Limit Supervision 1 Type No. 5252

Select the type for Limit Supervision 1.

The following are the selections for the parameter.

Number	Name	Description
0	No Action	Feature is disabled.
1	Supervise Low Limit	Supervision will act if the monitored signal falls below the set threshold.
2	Supervise High Limit	Supervision will act if the monitored signal exceeds the set threshold.

P 2.9.11.3 Limit Supervision 1 Threshold No. 5253

Set the value of the limit (Low/High limit) for Limit Supervision 1.

P 2.9.11.4 Limit Supervision 1 Enable **No. 4098**

Enables limit supervision of the chosen parameter.

The following are the selections for the parameter.

Number	Name
0	Disabled
1	Enabled
2	Active when Current Lim. Ramp event response is active
3	Enabled in run state only

7.3.9.12 Grid Frequency Supervision (Menu Index 2.9.12)

P 2.9.12.1 High Freq. Instant Fault Limit **No. 2840**

Set high limit for grid frequency. The converter trips when the actual grid frequency exceeds the limit; active only in run state.

P 2.9.12.2 High Freq. Delayed Fault Limit **No. 255**

Set high limit for grid frequency. The converter trips when actual grid frequency exceeds the limit longer than fault delay; active only in run state.

P 2.9.12.3 High Freq. Warning Limit **No. 257**

Set high limit for grid frequency warning. The warning appears when actual grid frequency exceeds this level; active only in run state.

P 2.9.12.4 Low Freq. Warning Limit **No. 259**

Low limit for grid frequency warning; warning appears if actual grid frequency is below this level; active only in run state.

P 2.9.12.5 Low Freq. Delayed Fault Limit **No. 258**

Low limit for grid frequency; trips if actual grid frequency is below this level longer than fault delay; active only in run state.

P 2.9.12.6 Low Freq. Instant Fault Limit **No. 2841**

Low limit for grid frequency; trips instantly if actual grid frequency is below this level; active only in run state.

P 2.9.12.7 Freq. Supervision Hysteresis **No. 256**

Hysteresis for grid frequency fault & warning limits in Hz; fault/warning remains active unless the frequency is above/below by the limit+/-hysteresis value.

P 2.9.12.8 High Freq. Fault Delay **No. 260**

Set the delay for triggering the Delayed Grid Frequency High fault.

P 2.9.12.9 Low Freq. Fault Delay **No. 261**

Set the delay for triggering the Delayed Grid Frequency Low fault.

7.3.9.13 Grid Voltage Supervision (Menu Index 2.9.13)

P 2.9.13.1 Grid Overvoltage Instant Fault Limit **No. 2842**

Overvoltage limit for grid voltage in % of nominal grid voltage; trips instantly if actual grid voltage exceeds this level; active only in run state.

P 2.9.13.2 Grid Overvoltage Delayed Fault Limit **No. 250**

Overvoltage limit for grid voltage in % of nominal grid voltage; trips if actual grid voltage exceeds this level longer than fault delay; active only in run state.

P 2.9.13.3 Grid Overvoltage Warning Limit **No. 252**

Overvoltage limit for grid voltage warning in % of nominal grid voltage; warning appears if actual grid voltage exceeds this level; active only in run state.

P 2.9.13.4 Grid Undervoltage Warning Limit **No. 253**

Undervoltage limit for grid voltage warning in % of nominal grid voltage; warning appears if actual grid voltage is below this level; active only in run state.

P 2.9.13.5 Grid Undervoltage Delayed Fault Limit **No. 262**

Undervoltage limit for grid voltage in % of nominal grid voltage; trips if actual grid voltage is below this level longer than fault delay; active only in run state.

P 2.9.13.6 Grid Undervoltage Instant Fault Limit **No. 2843**

Undervoltage limit for grid voltage in % of nominal grid voltage; trips instantly if actual grid voltage is below this level; active only in run state.

P 2.9.13.7 Grid Volt. Supervision Hysteresis **No. 251**

Hysteresis for grid voltage fault & warning limits in % of nominal grid voltage; fault/warning remains active unless the voltage percentage is above/below by the limit+-hysteresis value.

P 2.9.13.8 Grid Overvoltage Fault Delay **No. 254**

Set the delay for triggering the Delayed Grid Voltage High fault.

P 2.9.13.9 Grid Undervoltage Fault Delay **No. 263**

Set the delay for triggering the Delayed Grid Voltage Low fault.

7.3.9.14 Missing Grid Phase (Menu Index 2.9.14)

P2.9.12.1 Phase Fault Limit Run No. 266
Imbalance needed in run state for missing phase condition to be true.

P2.9.12.2 Phase Fault Limit Stop No. 264
Imbalance needed in stop state for missing phase condition to be true.

P2.9.12.3 Phase Fault Delay No. 265
Time required for missing phase condition is true until trip is generated.

7.3.9.15 Pre Charge Monitoring (Menu Index 2.9.15)

P2.9.13.1 Max. Pre-Charge Time No. 6564
Set maximum allowed pre-charging time in seconds.

P2.9.13.2 Min. Pre-Charge Time No. 6565
Set minimum allowed pre-charging time in seconds.

P2.9.13.3 Ext. Pre-Charge Monitor Response No. 6568
Set the response of external pre-charging monitoring exception.

The following are the selections for the parameter.

Number	Name	Description
0	No response	-
1	Info	The converter will issue an info event.
3	Warning	The converter will issue a warning event.
10	Fault	The converter will issue a fault event and stop modulation.
11	Fault, Open MCB	The converter will issue a fault event, stop modulation, and open the main circuit breaker.

7.3.10 External Grid Synchronization (Menu Index 2.10)

P 2.10.1 Ext. Grid Synchronize Input No. 6595

Set the digital input for external grid synchronization start request.

P 2.10.2 Ext. Grid Connect Enable Input No. 6598

Select a digital input for enabling the converter connection to the external grid after the synchronization is ready.

P 2.10.3 Ext. Grid Connect Input No. 6596

Select a digital input for the external grid connection.

P 2.10.4 Ext. Grid Connected Feedback Input No. 6597

Set the digital input for external grid connection feedback.

P 2.10.5 Ext. Grid Synchronized Output No. 6599

Set the digital output for the external grid synchronization ready.

P 2.10.6 Ext. Grid Connect Output No. 6600

Select a digital output for external grid connection.

P 2.10.7 Ext. Grid Connected Feedback Delay No. 6604

Set the delay from the feedback of external grid connection.

P 2.10.8 Ext. Grid Connected Response No. 6602

Set the response of the converter when the external grid is connected.
The following are the selections for the parameter.

Number	Name
0	No Operation Mode Change
1	Change to Ext. Grid Control Mode

P 2.10.9 Ext. Grid Control Mode No. 6603

Set the operation mode which the converter uses if mode change is set as a response to external grid connection. All the operation modes can be selected.

P 2.10.10 Ext. Grid Voltage Feedback Source No. 6605

Set the external grid voltage measurement configuration. The external grid synchronization will use this configuration to start the synchronization of the converter.

The following are the selections for the parameter.

Number	Name
0	Off
1	X52
2	X53

7.4 Maintenance & Service (Menu Index 3)

This group contains auxiliary parameters for monitoring, commissioning, and servicing the converter.

7.4.1 Software Information (Menu Index 3.1)

This group houses details about the software.

P 3.1.1 Application Version

Shows the version of the application software.

7.4.2 Events (Menu Index 3.2)

When encountering issues, the converter may issue events of the Info, Warning or Fault response type. This group contains information and parameters for monitoring and simulating these events.

Active Events

This is an active events screen shown only in the control panel. Only active warnings and faults events are displayed in this screen – info events are not. With MyDrive® Insight, the same information is available in the "Events" screen. Check the available information via the control panel or MyDrive® Insight.

All Events

This is the event history screen shown only in the control panel. With MyDrive® Insight, the same information is available in the "Events" screen. Check the available information via the control panel or MyDrive® Insight.

7.4.2.1 Event Simulation (Menu Index 3.2.3)

The event simulation feature can be used to trigger any converter event without meeting the event criteria. This can be used to safely preview how the converter behaves during specific events. For instance, some events may trigger other functions, such as indications through digital outputs. This feature is useful for checking the setup, configuration, and validity of such functions during specific events.

NOTICE

This feature is for commissioning and testing purposes. It is not meant for functional use.

WARNING

This feature can stop the converter and possibly trigger external events. Do not use without proper knowledge of the system.

How to use:

1. Refer to the Events Summary Table to get the event number and details for the specific event.
2. Set the event number with parameter No. 1402.
3. Activate the simulation by setting parameter No. 1401 to the desired simulation response.
4. To end the simulation set parameter No. 1401 back to "Disabled".
5. If required, give a Fault Reset command to acknowledge a simulated event.
6. If required, reboot the converter to acknowledge "Trip Locked" events.

P3.2.3.1 Simulate Event No. 1400

Simulates the selected event with the selected response. Simulation begins when changing value from Disabled. To reset a simulated event, this parameter needs to be set back to Disabled first.

Number	Name	Description
0	Disabled	Event simulator is inactive
1	Lowest Response	The event selected with parameter No. 1402 is activated with its lowest event response. Note that if the event can be configured with a response parameter, the response parameter's setting will apply to the simulation.
10	Highest Response	The event selected with parameter No. 1402 is activated with its highest event response. Note that if the event can be configured with a response parameter, the response parameter's setting will apply to the simulation.

P3.2.3.2 Simulate Persisting Event No. 1401

Select a response to trigger a persisting simulated event. Set back to 0 to allow a reset. Simulates the selected event with the selected response. Simulation begins when changing value from Disabled. To reset a simulated event, this parameter needs to be set back to Disabled first.

Number	Name	Description
0	Disabled	Event simulator is inactive
1	Lowest Response	The event selected with parameter No. 1402 is activated with its lowest event response. Note that if the event can be configured with a response parameter, the response parameter's setting will apply to the simulation.
10	Highest Response	The event selected with parameter No. 1402 is activated with its highest event response. Note that if the event can be configured with a response parameter, the response parameter's setting will apply to the simulation.

P3.2.3.3 Simulate Event Number No. 1402

Select an event to be simulated by its number. Refer to the **Error! Reference source not found.** section to check the number of each event.

7.4.3 Operational Counters (Menu Index 3.3)

This group shows readouts of converter's operational counters.

P3.3.1 Control Unit On Time No. 2000
Shows the total operating time for the control unit.

P3.3.2 Power Unit On Time No. 2001
Shows the total operating time for the power unit. The counter only increments if the DC link is powered.

P3.3.3 Energy Consumption No. 2002
Shows the energy consumed.

P3.3.4 Ground Faults No. 2004
Shows the total number of ground faults.

P3.3.5 Overvoltage Faults No. 2005
Shows the total number of overvoltage faults.

P3.3.6 Overcurrent Faults No. 2006
Shows the total number of overcurrent faults.

P3.3.7 Short Circuit Faults No. 2007
Shows the total number of short-circuit faults.

P3.3.8 Number of Starts No. 2008
Shows the number of starts of the converter.

P3.3.9 Active Running Hours No. 2009
Shows the total number of active running hours of the converter.

P3.3.10 Flash 0 Wear Counter No. 2100
Shows the erase count for most used flash 0 sector.

P3.3.11 Flash 1 Wear Counter No. 2101
Shows the erase count for most used flash 1 sector.

7.4.4 Backup & Restore (Menu Index 3.4)

This menu is used to access the backup and restore functions from the control panel.

7.4.4.1 Backup

This is a menu screen for creating parameter backups from the control panel. With MyDrive® Insight, similar options are available via the “Backup” button within the “Parameters” screen. Check the available settings via the control panel or MyDrive® Insight.

7.4.4.2 Restore

This is a menu for restoring parameter backups from the control panel. With MyDrive® Insight, similar options are available via the “Restore” button within the “Parameters” screen. Check the available settings via the control panel or MyDrive® Insight.

7.5 Customization (Menu Index 5)

7.5.1 Basic Settings (Menu Index 5.1)

7.5.1.1 P5.1.1 Date and Time No. 2800
Set the actual time and date. The format is YYYY-MM-DD and HH:MM: SS.

7.5.1.2 P5.1.2 Time Mode No. 6232
Select the time mode. Auto enables NTP.

Number	Name
0	Manual
1	Auto (NTP)

7.5.1.3 P5.1.3 NTP Server 1 No. 6233
Set the IPv4 address of the requested NTP server 1.

7.5.1.4 P5.1.4 NTP Server 2 No. 6234
Set the IPv4 address of the requested NTP server 2.

7.5.2 Control Panel (Menu Index 5.2)

The parameters in this group allow the selection of 1-5 signals for monitoring in the two control panel readout screens. These screens are visible in the panel's home screen, which can be accessed by pressing the "Home"-button (the house icon). Readout Screen 1 will appear first. By navigating downwards with the arrow-buttons, Readout Screen 2 will appear.

7.5.3 Readout Screen 1 (Menu Index 5.2.1)

P5.2.1.1 Readout Field 1.1 No. 300
Select the parameter for readout field (screen 1 field 1).

Number	Name
0	None
9044	DC-link Voltage
9041	Grid Frequency
9040	Grid Voltage
2950	Heat Sink Temperature
2952	Control Unit Temperature
9053	Grid Power Factor
5115	DC-link Current
5117	DC-link Power
9060	Grid Current
9064	Grid Active Power
9051	Grid Reactive Power

P5.2.1.2 Readout Field 1.2 No. 301
Select the parameter for readout field (screen 1 field 2).
Same selection as Field 1.1 (No. 300).

P5.2.1.3 Readout Field 1.3 No. 302
Select the parameter for readout field (screen 1 field 3).
Same selection as Field 1.1 (No. 300).

P5.2.1.4 Readout Field 1.4 No. 303
Select the parameter for readout field (screen 1 field 4).
Same selection as Field 1.1 (No. 300).

P5.2.1.5 Readout Field 1.5 No. 304
Select the parameter for readout field (screen 1 field 5).
Same selection as Field 1.1 (No. 300).

7.5.3.1 Readout Screen 1 (Menu Index 5.2.2)

P5.2.2.1 Readout Field 2.1 No. 310
Select the parameter for readout field (screen 2 field 1).
Same selection as Field 1.1 (No. 300).

P5.2.2.2 Readout Field 2.2 No. 311
Select the parameter for readout field (screen 2 field 2).
Same selection as Field 1.1 (No. 300).

P5.2.2.3 Readout Field 2.3 No. 312
Select the parameter for readout field (screen 2 field 3).
Same selection as Field 1.1 (No. 300).

P5.2.2.4 Readout Field 2.4 No. 313
Select the parameter for readout field (screen 2 field 4).
Same selection as Field 1.1 (No. 300).

P5.2.2.5 Readout Field 2.5 No. 314
Select the parameter for readout field (screen 2 field 5).
Same selection as Field 1.1 (No. 300).

7.5.4 Custom Status Word (Menu Index 5.3)

The custom status word can be used to define a status word for the converter, which includes freely selectable bits from a set of other status words. The following status words can be used to for the Custom Status Word:

- Grid Control Mode Selection Status Word, Application Status Word 1, Application Status Word 2, Limit Control Status Word

The custom status word can be monitored with parameter No. 2410.

The content for this word can be selected with individual parameters associated with each bit of the word. The content can be picked from other drive words. The value is given in the format of WBB, where W stands for the selection of the word and BB stands for the bit number within that word. Refer to the following table for the available content and their associated values.

Grid Control Mode Selection Status Word		Application Status Word 1	
100	Island Mode	200	Ready to Run
101	Droop Mode	201	Run
102	Droop with Base Load	202	Info
103	PQ Mode	203	Warning
104	AFE Mode (DC-link Voltage Control)	204	Fault
105	AFE (DC-link Current/Power)	205	PC (MyDrive Insight) Control Active
106	AFE (Active Current/Power	206	CP (Control Panle) Control Active
107		207	I/O Control Active
108		208	Fieldbus Control Active
109		209	
110		210	
111		211	Run Enable
112		212	Start Request
113		213	Quick Stop
Application Status Word 2		**Limit Control Status Word**	
300	Toggled Info	400	Pos. Active Current Limit
301	Toggled Warning	401	Neg. Active Current Limit
302	Toggled Fault	402	Short Term Current Injection Limit
303	Ready to Start Pre-charging	403	
304	Ready to Close MCB	404	DC-link Overvoltage control
305	Pre-charging Detected	405	DC-link Undervoltage control
306	Pre-charging Command	406	Pos. Active Power Limit
307	MCB Close Command	407	Neg. Active Power Limit
308	MCB Feedback	408	Pos. Reactive Current Limit
309	Switch Off Request	409	Neg. Reactive Current Limit
310	Pre Charge Ready	410	
311	MCB Close Enabled	411	
312	Ready to Switch On	412	
313	LCL Filter Energized	413	

P 5.3.1 Custom Status Word B0

Select the content of the respective bit of the custom status word. The content can be picked from the above table.

P 5.3.2 Custom Status Word B1

Select the content of the respective bit of the custom status word. The content can be picked from the above table.

P 5.3.3 Custom Status Word B2

Select the content of the respective bit of the custom status word. The content can be picked from the above table.

P 5.3.4 Custom Status Word B3

Select the content of the respective bit of the custom status word. The content can be picked from the above table.

P 5.3.5 Custom Status Word B4

Select the content of the respective bit of the custom status word. The content can be picked from the above table.

P 5.3.6 Custom Status Word B5

Select the content of the respective bit of the custom status word. The content can be picked from the above table.

P 5.3.7 Custom Status Word B6

Select the content of the respective bit of the custom status word. The content can be picked from the above table.

P 5.3.8 Custom Status Word B7

Select the content of the respective bit of the custom status word. The content can be picked from the above table.

P 5.3.9 Custom Status Word B8

Select the content of the respective bit of the custom status word. The content can be picked from the above table.

P 5.3.10 Custom Status Word B9

Select the content of the respective bit of the custom status word. The content can be picked from the above table.

P 5.3.11 Custom Status Word B10

Select the content of the respective bit of the custom status word. The content can be picked from the above table.

P 5.3.12 Custom Status Word B11

Select the content of the respective bit of the custom status word. The content can be picked from the above table.

P 5.3.13 Custom Status Word B12

Select the content of the respective bit of the custom status word. The content can be picked from the above table.

P 5.3.14 Custom Status Word B13

Select the content of the respective bit of the custom status word. The content can be picked from the above table.

P 5.3.15 Custom Status Word B14

Select the content of the respective bit of the custom status word. The content can be picked from the above table.

P 5.3.16 Custom Status Word B15

Select the content of the respective bit of the custom status word. The content can be picked from the above table.

7.6 Option Settings (Menu Index 9)

7.6.1 I/O And Relay Status (Menu Index 9.3)

P 9.3.1 Digital Input Bit Word No. 1614

Shows the bitwise status of each digital input of this board.

Bit No.	Name	Description
0	Digital Input T13	TRUE = Over 15 V DC is applied between X13 T13 and Digital Input GND. FALSE = Less than 5 V DC is applied between X13 T13 and Digital Input GND.
1	Digital Input T14	TRUE = Over 15 V DC is applied between X13 T14 and Digital Input GND. FALSE = Less than 5 V DC is applied between X13 T14 and Digital Input GND.
2	Digital Input T15	TRUE = Over 15 V DC is applied between X13 T15 and Digital Input GND. FALSE = Less than 5 V DC is applied between X13 T15 and Digital Input GND.
3	Digital Input T16	TRUE = Over 15 V DC is applied between X13 T16 and Digital Input GND. FALSE = Less than 5 V DC is applied between X13 T16 and Digital Input GND.
4	Digital Input T17	TRUE = Over 15 V DC is applied between X13 T17 and Digital Input GND. FALSE = Less than 5 V DC is applied between X13 T17 and Digital Input GND.
5	Digital Input T18	TRUE = Over 15 V DC is applied between X13 T18 and Digital Input GND. FALSE = Less than 5 V DC is applied between X13 T18 and Digital Input GND.
6-11	Reserved	
12	Thermistor T71	TRUE = More than 4 kΩ is connected between X51 T71 and T72. FALSE = Less than 4 kΩ is connected between X51 T71 and T72.
13-15	Reserved	

P 9.3.2 Digital Output Bit Word **No. 1615**

Shows the bitwise status of each digital output of this board.

Bit No.	Name	Description
0-1	Reserved	
2	Digital Output T21	TRUE = Connection between X13 T21 and I/O GND is active. FALSE = Connection between X13 T21 and I/O GND is active.
3	Digital Output T22	TRUE = Connection between X13 T22 and I/O GND is active. FALSE = Connection between X13 T22 and I/O GND is active.
4-11	Reserved	
12	Relay T02	TRUE = Connection between X101 T01 (COM) and T02 (NO) is active. FALSE = Connection between X101 T01 (COM) and T03 (NC) is active.
13	Relay T05	TRUE = Connection between X102 T04 (COM) and T05 (NO) is active. FALSE = Connection between X102 T04 (COM) and T06 (NC) is active.
14	Relay T08	TRUE = Connection between X103 T04 (COM) and T08 (NO) is active. FALSE = Connection between X103 T04 (COM) and T08 (NO) is inactive.
15	Reserved	

P 9.3.3 T31 Analog Output Value **No. 1613**

Shows the actual value of the terminal.

P 9.3.4 T33 Analog Input Value **No. 1611**

Shows the actual value of the terminal.

P 9.3.5 T34 Analog Input Value **No. 1612**

Shows the actual value of the terminal.

7.6.2 Digital Inputs/Outputs (Menu Index 9.4)

7.6.2.1 Input T13 (Menu Index 9.4.1)

P 9.4.1.1 T13 Terminal Mode **No. 2015**

Select the mode for the terminal.
The following are the selections for the parameter.

Number	Name	Description
0	Inactive	
3	Digital input	The terminal is configured as Boolean input (true/false).

P 9.4.1.2 T13 Signal Inversion **No. 2291**

Select whether the signal of the terminal is inverted.

The following are the selections for the parameter.

Number	Name	Description
0	Non-Inverted	The signal is not inverted.
1	Inverted	The signal is logically inverted.

P 9.4.1.3 T13 Standard Debounce Filtering Time **No. 2024**

Set the standard debounce filtering time for the terminal.

7.6.2.2 Input T14 (Menu Index 9.4.2)

P 9.4.2.1 T14 Terminal Mode **No. 2016**

Select the mode for the terminal. Selection is similar to T13 Terminal Mode.

P 9.4.2.2 T14 Signal Inversion **No. 2292**

Select whether the signal of the terminal is inverted. The selection is similar to T13 Signal Inversion.

P 9.4.2.3 T14 Standard Debounce Filtering Time **No. 2029**

Set the standard debounce filtering time for the terminal.

7.6.2.3 Input T15 (Menu Index 9.4.3)

P 9.4.3.1 T15 Terminal Mode **No. 2022**

Select the mode for the terminal. Selection is similar to T13 Terminal Mode.

P 9.4.3.2 T15 Signal Inversion **No. 2295**

Select whether the signal of the terminal is inverted. The selection is similar to T13 Signal Inversion.

P 9.4.3.3 T15 Standard Debounce Filtering Time **No. 2297**

Set the standard debounce filtering time for the terminal.

7.6.2.4 Input T16 (Menu Index 9.4.4)

P 9.4.4.1 T16 Terminal Mode **No. 2298**

Select the mode for the terminal. Selection is similar to T13 Terminal Mode.

P 9.4.4.2 T16 Signal Inversion **No. 2296**

Select whether the signal of the terminal is inverted. The selection is similar to T13 Signal Inversion.

P 9.4.4.3 T16 Standard Debounce Filtering Time **No. 2060**

Set the standard debounce filtering time for the terminal.

7.6.2.5 Input T17 (Menu Index 9.4.5)

P 9.4.5.1 T17 Terminal Mode **No. 2217**

Select the mode for the terminal. Selection is similar to T13 Terminal Mode.

P 9.4.5.2 T17 Signal Inversion **No. 2293**

Select whether the signal of the terminal is inverted. The selection is similar to T13 Signal Inversion.

P 9.4.5.3 T17 Standard Debounce Filtering Time No. 2034

Set the standard debounce filtering time for the terminal.

7.6.2.6 Input T18 (Menu Index 9.4.6)

P 9.4.6.1 T18 Terminal Mode No. 2018

Select the mode for the terminal. Selection is similar to T13 Terminal Mode.

P 9.4.6.2 T18 Signal Inversion No. 2294

Select whether the signal of the terminal is inverted. The selection is similar to T13 Signal Inversion.

P 9.4.6.3 T18 Standard Debounce Filtering Time No. 2039

Set the standard debounce filtering time for the terminal.

7.6.2.7 Output T21 (Menu Index 9.4.7)

P9.4.7.1 T21 Terminal Mode No. 4015

Select the mode for the terminal.

Number	Name
0	Inactive
1	Digital Output

P9.4.7.2 T21 Digital Output Type No. 4013

Select the operating logic for the digital output.

The following are the selections for the parameter.

Number	Name	Description
0	Tri state	Disable output (high impedance).
1	Open collector sink (NPN)	Open collector sink (NPN).
2	Open collector source (PNP)	Open collector source (PNP).
3	Push pull	Terminal can both sink and source.

7.6.2.8 Output T22 (Menu Index 9.4.8)

P 9.4.8.1 T22 Terminal Mode No. 4016
Select the mode for the terminal.

Number	Name
0	Inactive
1	Digital Output

P 9.4.8.2 T22 Digital Output Type

Select the operating logic for the digital output.

The following are the selections for the parameter.

Number	Name	Description
0	Tri state	Disable output (high impedance).
1	Open collector sink (NPN)	Open collector sink (NPN).
2	Open collector source (PNP)	Open collector source (PNP).
3	Push pull	Terminal can both sink and source.

7.6.3 Analog Inputs/Outputs (Menu Index 9.5)

P9.5.1.1 T31 Terminal Mode No. 2019
Select the mode for the terminal.

Number	Name
0	Inactive
5	Analog Output

P9.5.1.2 T31 Terminal Type No. 2284
Select the type of terminal. If voltage is selected, the unit is V. If current is selected, the unit is mA.

Number	Name
0	Off
1	Voltage
2	Current

P9.5.1.3 T31 Minimum Value No. 2283
Set the voltage or current representing 0% of the signal.

P9.5.1.4 T31 Maximum Value No. 2282
Set the voltage or current representing 100% of the signal.

Input T33

P9.5.2.1 T33 Terminal Mode No. 2020
Select the mode for the terminal.

Number	Name
0	Inactive
6	Analog Input

P9.5.2.2 T33 Terminal Type No. 2273
Select the type of terminal. If voltage is selected, the unit is V. If current is selected, the unit is mA.

Number	Name
1	Voltage
2	Current

P9.5.2.3 T33 Minimum Value No. 2272
Set the voltage or current representing 0% of the signal.

P9.5.2.4 T33 Maximum Value No. 2271
Set the voltage or current representing 100% of the signal.

P9.5.2.5 T33 Filter Time No. 2270
Set the filter time for the terminal.

P9.5.2.6 T33 Live Zero Threshold Value No. 2274
Set the live zero threshold value for the terminal. The response to a live zero event is defined with parameter No. 4555 “Live Zero Response".

P9.5.2.7 T33 Live Zero Timeout Value No. 2275
Set the live zero timeout value for the terminal. The response to a live zero event is defined with parameter No. 4555 “Live Zero Response".

Input T34
P9.5.3.1 T34 Terminal Mode No. 2021
Select the mode for the terminal.

Number	Name
0	Inactive
6	Analog Input

P9.5.3.2 T34 Terminal Type No. 2279
Select the type of terminal. If voltage is selected, the unit is V. If current is selected, the unit is mA.

Number	Name
1	Voltage
2	Current

P9.5.3.3 T34 Minimum Value No. 2278
Set the voltage or current representing 0% of the signal.

P9.5.3.4 T34 Maximum Value No. 2277
Set the voltage or current representing 100% of the signal.

P9.5.3.5 T34 Filter Time No. 2276
Set the filter time for the terminal.

P9.5.3.6 T34 Live Zero Threshold Value No. 2280
Set the live zero threshold value for the terminal. The response to a live zero event is defined with parameter No. 4555 “Live Zero Response".

P9.5.3.7 T34 Live Zero Timeout Value No. 2281
Set the live zero timeout value for the terminal. The response to a live zero event is defined with parameter No. 4555 “Live Zero Response".

7.6.4 Temperature Measurement

This group and its subgroups appear only if a Temperature Measurement OC7T0 option is included in the converter. This menu appears as many times as there are these options in the system. Each menu and its parameters have the suffix of their option slot.

7.6.4.1 Temperature Measurement Status

P9.3.2 T4 Temperature Value No. 4040
Shows the measured temperature of the terminal.

P9.3.3 T8 Temperature Value No. 4041
Shows the measured temperature of the terminal.

P9.3.4 T12 Temperature Value No. 4042
Shows the measured temperature of the terminal.

P9.3.5 T16 Temperature Value No. 4043
Shows the measured temperature of the terminal.

P9.3.6 T20 Temperature Value No. 4044
Shows the measured temperature of the terminal.

7.6.4.2 Temperature inputs

Input T4

P9.4.1.1 T4 Terminal Mode No. 4045
Select the mode for the terminal.

Number	Name
0	Inactive
7	Temperature input

P9.4.1.2 T4 Connection Type No. 4046

Select the connection type for the sensor.

Number	Name
0	No sensor
2	2-wire
3	3-wire
4	4-wire

P9.4.1.3 T4 Temperature Sensor Type No. 4047

Select which type of temperature sensor is connected to the terminal.

Number	Name
0	No sensor
1	Pt100
2	2xPt100
3	3xPt100
4	Pt1000
5	Ni1000Tk5000
6	Ni1000Tk6180
7	KTY84-1x0
8	KTY84-151
9	KTY84-152
10	KTY81/82-1x0
11	KTY81/82-121
12	KTY81/82-122
13	KTY81/82-151
14	KTY81/82-152
15	KTY81/82-2x0
16	KTY81/82-221
17	KTY81/82-222
18	KTY81/82-251
19	KTY81/82-252

P9.4.1.4 T4 Offset No. 4048

Set the offset of the temperature measured.

Input T8

P9.4.2.1 T8 Terminal Mode No. 4049

Select the mode for the terminal.

Number	Name
0	Inactive
7	Temperature input

P9.4.2.2 T8 Connection Type No. 4050
Select the connection type for the sensor.

Number	Name
0	No sensor
2	2-wire
3	3-wire
4	4-wire

P9.4.2.3 T8 Temperature Sensor Type No. 4051
Select which type of temperature sensor is connected to the terminal.

Number	Name
0	No sensor
1	Pt100
2	2xPt100
3	3xPt100
4	Pt1000
5	Ni1000Tk5000
6	Ni1000Tk6180
7	KTY84-1x0
8	KTY84-151
9	KTY84-152
10	KTY81/82-1x0
11	KTY81/82-121
12	KTY81/82-122
13	KTY81/82-151
14	KTY81/82-152
15	KTY81/82-2x0
16	KTY81/82-221
17	KTY81/82-222
18	KTY81/82-251
19	KTY81/82-252

P9.4.2.4 T8 Offset No. 4052
Set the offset of the temperature measured.

Input T12

P9.4.3.1 T12 Terminal Mode No. 4053
Select the mode for the terminal.

Number	Name
0	Inactive
7	Temperature input

P9.4.3.2 T12 Connection Type No. 4054

Select the connection type for the sensor.

Number	Name
0	No sensor
2	2-wire
3	3-wire
4	4-wire

P9.4.3.3 T12 Temperature Sensor Type No. 4055

Select which type of temperature sensor is connected to the terminal.

Number	Name
0	No sensor
1	Pt100
2	2xPt100
3	3xPt100
4	Pt1000
5	Ni1000Tk5000
6	Ni1000Tk6180
7	KTY84-1x0
8	KTY84-151
9	KTY84-152
10	KTY81/82-1x0
11	KTY81/82-121
12	KTY81/82-122
13	KTY81/82-151
14	KTY81/82-152
15	KTY81/82-2x0
16	KTY81/82-221
17	KTY81/82-222
18	KTY81/82-251
19	KTY81/82-252

P9.4.3.4 T12 Offset No. 4056

Set the offset of the temperature measured.

Input T16

P9.4.4.1 T16 Terminal Mode No. 2298

Select the mode for the terminal.

Number	Name
0	Inactive
7	Temperature input

P9.4.4.2 T16 Connection Type No. 4058

Select the connection type for the sensor.

Number	Name
0	No sensor
2	2-wire
3	3-wire
4	4-wire

P9.4.4.3 T16 Temperature Sensor Type No. 4059

Select which type of temperature sensor is connected to the terminal.

Number	Name
0	No sensor
1	Pt100
2	2xPt100
3	3xPt100
4	Pt1000
5	Ni1000Tk5000
6	Ni1000Tk6180
7	KTY84-1x0
8	KTY84-151
9	KTY84-152
10	KTY81/82-1x0
11	KTY81/82-121
12	KTY81/82-122
13	KTY81/82-151
14	KTY81/82-152
15	KTY81/82-2x0
16	KTY81/82-221
17	KTY81/82-222
18	KTY81/82-251
19	KTY81/82-252

P9.4.4.4 T16 Offset No. 4060

Set the offset of the temperature measured.

Input T20

P9.4.5.1 T20 Terminal Mode No. 4017

Select the mode for the terminal.

No.	Name
0	Inactive
7	Temperature input

P9.4.5.2 T20 Connection Type No. 4062
Select the connection type for the sensor.

Number	Name
0	No sensor
2	2-wire
3	3-wire
4	4-wire

P9.4.5.3 T20 Temperature Sensor Type No. 4063
Select which type of temperature sensor is connected to the terminal.

Number	Name
0	No sensor
1	Pt100
2	2xPt100
3	3xPt100
4	Pt1000
5	Ni1000Tk5000
6	Ni1000Tk6180
7	KTY84-1x0
8	KTY84-151
9	KTY84-152
10	KTY81/82-1x0
11	KTY81/82-121
12	KTY81/82-122
13	KTY81/82-151
14	KTY81/82-152
15	KTY81/82-2x0
16	KTY81/82-221
17	KTY81/82-222
18	KTY81/82-251
19	KTY81/82-252

P9.4.5.4 T20 Offset No. 4064
Set the offset of the temperature measured.

7.6.5 Voltage Measurement
This group and its subgroups appear only if a Voltage Measurement OC7V0 option is included in the converter. This menu appears as many times as there are these options in the system. Each menu and its parameters have the suffix of their option slot.

7.6.5.1 Voltage Measurement Status
P9.3.1 X52 Voltage No. 4086
Shows the voltage vector length in the external voltage measurement board channel X52.

P9.3.2 X52 Frequency No. 4087
Shows the frequency in the external voltage measurement board channel X52.

P9.3.3 X52 Phase Diff. No. 4088
Shows the phase difference between external voltage measurement board channel X52 phase and control's coordinate system.

P9.3.4 X52 Voltage L1 No. 4082
Shows the voltage of pin L1 of connector X52 of the external voltage measurement board.

P9.3.5 X52 Voltage L3 No. 4083
Shows the voltage of pin L3 of connector X52 of the external voltage measurement board.

P9.3.6 X53 Voltage No. 4089
Shows the voltage vector length in the external voltage measurement board channel X53.

P9.3.7 X53 Frequency No. 4090
Shows the frequency in the external voltage measurement board channel X53.

P9.3.8 X53 Phase Diff. No. 4091
Shows the phase difference between external voltage measurement board channel X53 phase and control's coordinate system.

P9.3.9 X53 Voltage L1 No. 4084
Shows the voltage of pin L1 of connector X53 of the external voltage measurement board.

P9.3.10 X53 Voltage L3 No. 4085
Shows the voltage of pin L3 of connector X53 of the external voltage measurement board.

7.6.5.2 Voltage Input X52

P9.4.1 X52 Terminal Mode No. 4099
Select operation mode of terminals on connector X52.

Number	Name	Description
0	Inactive	Connector X52 does not measure anything.
1	AC Voltage	Connector X52 is configured to measure AC voltage.
2	DC Voltage	Connector X52 is configured to measure DC voltage.

P9.4.2 X52 Terminal Voltage Range No. 4100
Set the terminal voltage range for voltage measurement option connector X52.

P9.4.3 X52 Meas. Transformer Grid-Side Voltage No. 4101
Set the grid-side winding nominal voltage of measurement transformer connected to voltage measurement option X52.

P9.4.4 X52 Meas. Transformer Converter-Side Voltage No. 4102
Set the converter-side winding nominal voltage of measurement transformer connected to voltage measurement option X52.

P9.4.5 X52 Meas. Transformer Phase Shift No. 4103
Set the phase shift of converter-side voltage to grid-side voltage of measurement transformer connected to voltage measurement option X52. Positive values (counterclockwise) phase-lead. Negative values (clockwise) phase-lag.

7.6.5.3 Voltage Input X53

P9.5.1 X53 Terminal Mode No. 4104

Select the operation mode of terminals on connector X53.

Number	Name	Description
0	Inactive	Connector X53 does not measure anything.
1	AC Voltage	Connector X53 is configured to measure AC voltage.
2	DC Voltage	Connector X53 is configured to measure DC voltage.

P9.5.2 X53 Terminal Voltage Range No. 4105

Set the terminal voltage range for voltage measurement option connector X53.

P9.5.3 X53 Meas. Transformer Grid-Side Voltage No. 4106

Set the grid-side winding nominal voltage of measurement transformer connected to voltage measurement option X53.

P9.5.4 X53 Meas. Transformer Converter-Side Voltage No. 4107

Set the converter-side winding nominal voltage of measurement transformer connected to voltage measurement option X53.

P9.5.5 X53 Meas. Transformer Phase Shift No. 4108

Set the phase shift of converter-side voltage to grid-side voltage of measurement transformer connected to voltage measurement option X53. Positive values (counterclockwise) phase-lead. Negative values (clockwise) phase-lag.

7.7 Connectivity

This section provides information about configuring and monitoring all types of communication interfaces as well as the communication and fieldbus protocols available. Following are the available interfaces:

- Communication interface X0 (service port).
- Communication interface X1/X2 (fieldbus ports).
- Attached communication options.

Note that the availability of different fieldbus protocols depends on the product.

7.7.1 Integrated Communication

7.7.1.1 Communication interfaces

7.7.1.2 Host Settings

P10.1.1.1.1 Fully Qualified Domain Name No. 7036

Fully Qualified Domain Name. Consists of a host name label and at least 1 higher-level domain separated by the symbol "." with up to 240 characters in total. Each label contains up to 63 characters and starts with a lowercase letter and ends with alphanumeric lowercase character and have as interior characters only alphanumeric lowercase characters and '-'.

7.7.1.3 Ethernet Interface X0

IPv4 Settings

This is a menu screen for enabling IP configuration of the X0 interface. Check the available settings via the control panel or MyDrive® Insight.

IPv4 Status

This is a menu screen containing information about the IP configuration of the X0 interface. Check the available information via the control panel or MyDrive® Insight.

7.7.1.4 Ethernet Interface X1/X2

IPv4 Settings

This is a menu screen for enabling IP configuration of the X1/2 interface. Check the available settings via the control panel or MyDrive® Insight.

IPv4 Status

This is a menu screen containing information about the IP configuration of the X1/X2 interface. Check the available information via the control panel or MyDrive® Insight.

7.7.1.5 Ethernet port X0

X0 Settings

P10.1.1.4.1.1 Link configuration X0 No. 7047

Select the configuration of the Ethernet link parameters.

Number	Name
0	Auto negotiation
1	10 Mbps full duplex
2	10 Mbps half duplex
3	100 Mbps full duplex
4	100 Mbps half duplex

7.7.1.6 Ethernet port X1

X1 Settings

P10.1.1.5.1.1 Link Configuration X1 No. 7048

Select the configuration of the Ethernet link parameters.

Number	Name
0	Auto negotiation
1	10 Mbps full duplex
2	10 Mbps half duplex
3	100 Mbps full duplex
4	100 Mbps half duplex

7.7.1.7 Ethernet port X2

X2 Settings

P10.1.1.6.1.1 Link Configuration X2 No. 7049

Select the configuration of the Ethernet link parameters.

Number	Name
0	Auto negotiation
1	10 Mbps full duplex
2	10 Mbps half duplex
3	100 Mbps full duplex
4	100 Mbps half duplex

7.7.1.8 Port Mirroring

This is a menu screen for enabling and disabling the port-mirroring function for network troubleshooting with a network analyzer tool. Check the available configurations via the control panel or MyDrive® Insight.

7.7.2 Protocols

7.7.2.1 PROFINET®

Status

PROFINET® Report

This is the PROFINET® report screen showing active PROFINET® connection and configuration information. Check the available information via the control panel or MyDrive® Insight.

Configuration

P10.1.2.1.2.1 Name of Station No. 7080

Set the name of the station. The PROFINET® device is identified by its name of station. Each name must be unique in the network.

Diagnosis

P10.1.2.1.3.1 Diagnostic Fault No. 7081

Enables diagnostic faults. When disabled the device will not send any PROFINET® diagnosis message with severity "Fault" when a fault is present on device.

Number	Name	Description
0	Disabled	Fault diagnosis messages are not sent.
1	Enabled	Fault diagnosis messages are sent.

P10.1.2.1.3.2 Diagnostic Warning No. 7083

Enables diagnostic warning. When disabled the device will not send any PROFINET® diagnosis message with severity "Maintenance required" when a warning is present on device.

Number	Name	Description
0	Disabled	Warning diagnosis messages are not sent.
1	Enabled	Warning diagnosis messages are sent.

7.7.2.2 Modbus® TCP

Configuration

P10.1.2.2.1.1 Persistent Storage No. 7061

Select if persistent storage is active for Modbus® writes.

Number	Name	Description
0	Disabled	When writing to configuration parameters via a Modbus® protocol, the latest written value is not stored to memory. If the converter is rebooted the latest written value is lost.
1	Enabled	When writing to configuration parameters via a Modbus® protocol, the latest written value is stored to memory. If the converter is rebooted the latest written value is retained.

P10.1.2.2.1.2 Byte Order No. 7062

Byte Order refers to how data is stored in memory. In Modbus communication, this determines the sequence in which bytes are sent or received. Using this parameter select the byte order as described below,

Number	Name	Description
0	Big Endian	The most significant byte (MSB) is stored or transmitted first, thus decreasing byte order. Suppose the system has an 8-bit register, for holding the value 0xAB starting at address 1000. Then at location1000: 0xA (MSB) will be stored and at location1001: 0xB (LSB) will be stored.
1	Little Endian	The least significant byte (LSB) is stored or transmitted first, thus increasing byte order. Suppose the system has an 8-bit register, for holding the value 0xAB starting at address 1000. Then at location1000: 0xB (LSB) will be stored and at location1001: 0xA (MSB) will be stored.

P10.1.2.2.1.3 Word Order No. 7063

Select the word order.

Number	Name	Description
0	Big Endian	The most significant byte (MSB) is stored or transmitted first, thus decreasing byte order. Suppose the system has an 8-bit register, for holding the value 0xABCD starting at address 1000. Then at location1000: 0xAB (MSB) will be stored and at location1001: 0xCD (LSB) will be stored.
1	Little Endian	The least significant byte (LSB) is stored or transmitted first, thus increasing byte order. Suppose the system has an 8-bit register, for holding the value 0xABCD starting at address 1000. Then at location1000: 0xCD (LSB) will be stored and at location1001: 0xAB (MSB) will be stored.

8 Troubleshooting

8.1 Viewing Warnings

When a warning event occurs, the status indicators (halo and WARN) turn yellow. The drive remains operational and when the trigger for the warning is corrected, the indicators turn white.

To view the details of a warning, go to parameter group ***6.4.1 Active Events***.

To view the history of events for the drive, go to parameter group ***6.4.2 Event History***.

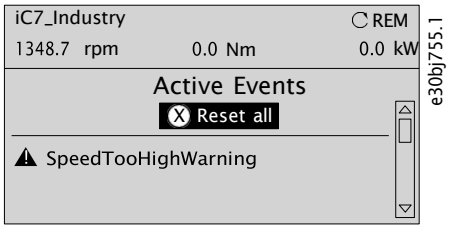


Figure 48: Warnings

8.2 Viewing and Resetting Faults

When a fault occurs in the drive, the status indicators halo and FAULT turn red. The control panel display shows the name of the fault, and allows a direct reset.

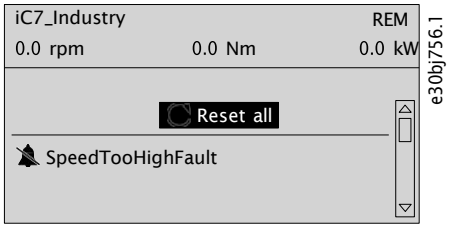


Figure 49: Fault on the Control Panel

To view details about a fault and its cause, select the fault in the list shown on the control panel and press *[OK]*.

If the control panel display has changed, simultaneously press the left and right arrows on the control panel to return to parameter group ***6.4.1 Active Events***.

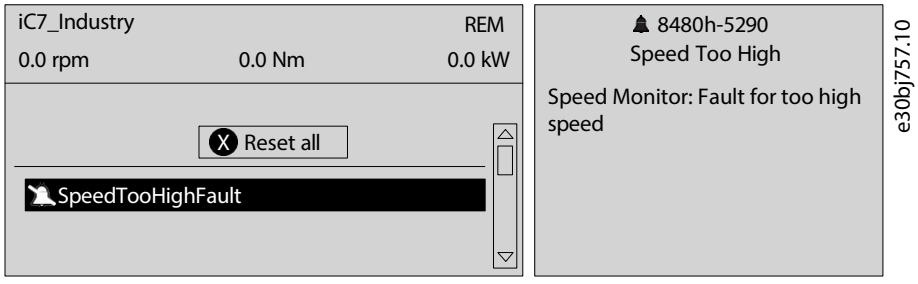


Figure 50: View Active Faults

1. Resolve all triggers causing the fault.
2. Select *Reset all* and press *[OK]*.

8.3 Reading the Event Summary Table

Group number and number (columns 1–2)

Events in iC7 drives have 2 different identifiers: Group numbers and Individual numbers.

The group numbers for iC7 drives follow the DRIVECOM industry standard error code specification. The specification originated with the Interbus communication profile. The Interbus V3.0 base profile was released on 2018-04-19. The inverter specific profile was released on 1997-12-15. The error code specification was adopted by CAN in Automation and ODVA and is used within their respective Drive Profile. The list of standardized error codes can be found within IEC 61800-7-201.

Unlike individual numbers, the group numbers are not unique since multiple errors can be related to each other. An example is different ground faults which share the Group Number 0x2330.

Display name and description (columns 3–4)

The columns are showing the name and a short description of the event. A few display names are marked with a * which indicates that the event can be configured via a parameter.

Type of event (columns 5–8)

The event summary table shows column names where I – Info, W – Warning, F – Fault, and PF – Protected Fault.

- **Info:** The notification provides information.
- **Warning:** The notification informs that an undesired event is happening. The converter can continue operation, but it might be with reduced performance and/or the converter might trip soon.
- **Fault (Trip):** An error notification informs that an undesired high-severity event occurred. Modulation stops immediately. The error message and the error can be reset without power cycling the converter.
- **Protected Fault (Trip Lock):** An error notification informs that an undesired high-severity event happened. Modulation stops immediately. The error message and the error can be reset after power cycling the converter.

Action of the inverter and brake chopper (column 9)

The columns show the possible action of the converter:

- **RC:** Converter ramps current to 0 before stopping modulation.
- **C:** Converter stops modulation immediately.

8.4 Events Summary for Grid Converter Application Software

The following table lists the events that can occur in the Grid Converter application software.

Table 30: Summary Table

Group Number (Hex)	Number (Decimal)	Display Name	Description	Type of Event				Converter Action
				I	W	F	PF	
0x20FF	4372	Current Injection Limit	The time limit for the short term current injection has been exceeded.		X	X		C
0x2110	4379	CM Current High	An excessive common mode current has been detected in the LCL-filter.		X	X		C

Table 30: Summary Table *(continued)*

Group Number (Hex)	Number (Decimal)	Display Name	Description	Type of Event				Converter Action
				I	W	F	PF	
0x2212	4374	DC-link Resonance	A resonance on the DC link with excessive RMS current values has been detected.		X	X		C
0x2221	4384	Thermal Overload Rectifier	The rectifier is thermally overloaded. Mission profile is too demanding.		X	X		C
0x2222	4373	DC-link Overcurrent	An overcurrent on the main DC-link capacitors has been detected.		X	X		C
0x2311	4097	Inverter Overload	Thermal overload is detected in the inverter of the drive. Reduce the output load.		X	X		C
0x2311	4368	Output Current High 0	The output current of the drive has exceeded its normal range at low speed. Shock load or too fast acceleration with high-inertia loads can cause this fault. Check that the motor size matches the drive and the motor data is correct. Check that the motor shaft can be turned.		X	X		C
0x2311	4369	Output Current High 1	The output current of the drive has exceeded its normal range. Shock load or too fast acceleration with high-inertia loads can cause this fault. Check that the motor size matches the drive and the motor data is correct. Check that the motor shaft can be turned.		X	X		C
0x2311	4375	Excessive Current Limiting	The output current of the drive has exceeded the current limit multiple times. Check that the motor size matches the drive and the motor data is correct. Check that the motor shaft can be turned.		X	X		C
0x2311	4377	Smart Derating Fault	A Smart Derating fault is detected. The load is too demanding for the current derating level. Lower the switching frequency if possible.		X	X		C
0x2311	4380	Current Limit Setting Fault	The actual current limit setting is too high relative to the selected constant control frequency level. Reduce the control frequency setting or reduce the current limit setting.			X		C
0x2330	4352	Ground Fault 0	A high-impedance ground fault is detected on the output. Check the insulation of motor cable and motor.		X	X		C

Table 30: Summary Table *(continued)*

Group Number (Hex)	Number (Decimal)	Display Name	Description	Type of Event				Converter Action
				I	W	F	PF	
0x2330	4353	Ground Fault 1	A high-impedance ground fault is detected on the output. Check the insulation of motor cable and motor.		X	X		C
0x2330	4354	Ground Fault 2	A low-impedance ground fault is detected on the output. Check the insulation of motor cable and motor.		X		X	C
0x2330	4355	Ground Fault 21	A high or low-impedance ground fault is detected on the output. Check the insulation of motor cable and motor.		X		X	C
0x2340	4356	Inverter Short Circuit	A short circuit at the inverter output is detected. Check the motor and motor cable.		X		X	C
0x2340	4370	Output Current High 2	A critical output overcurrent has been detected. Check for short circuits on the output.		X		X	C
0x2340	4649	Desat Gate Driver	The gate driver has detected desaturation condition.			X		C
0x23FE	4371	Current Imbalance	A current imbalance between paralleled power units has been detected.		X			
0x23FF	4175	Motor Disconnected	The motor is disconnected.		X	X		C
0x23FF	4176	Missing Motor Phase	A missing motor phase is detected. Check motor, motor cables, and connections.		X	X		C
0x3110	4162	Grid Voltage Spikes	Excessive spikes on the grid voltage have been detected.		X	X		C
0x3110	4164	Grid Voltage High	Grid voltage (RMS) above the normal operating range is detected.		X	X		C
0x3110	5392	DelayedGridVoltageHigh-Fault	Delayed Grid Voltage High Fault.			X		C
0x3110	5396	GridVoltageHighWarning	Grid Voltage High Warning.		X			
0x3120	4165	Grid Voltage Low	A grid voltage (RMS) below the normal operating range is detected.		X	X		C
0x3120	5393	DelayedGridVoltageLow-Fault	Delayed Grid Voltage Low Fault.			X		C
0x3120	5397	GridVoltageLowWarning	Grid Voltage Low Warning.		X			

Table 30: Summary Table *(continued)*

Group Number (Hex)	Number (Decimal)	Display Name	Description	Type of Event				Converter Action
				I	W	F	PF	
0x3130	4160	Missing Grid Phase	A missing phase is detected on the grid side. Check the grid supply, cables, connections, and fuses.		X	X		C
0x3130	4163	Grid Imbalance	A large imbalance of the grid voltages is detected. Check for uneven loads on the grid.		X	X		C
0x3140	4161	Grid Frequency Out of Range	A grid frequency outside the normal operating range is detected.		X	X		C
0x3140	4166	Grid Synchronization Error	The drive is unable to maintain the synchronization to the grid voltage.		X	X		C
0x3141	5390	DelayedGridFrequency-HighFault	Delayed Grid Frequency High Fault.			X		C
0x3141	5394	GridFrequencyHighWarning	Grid Frequency High Warning.		X			
0x3142	5391	DelayedGridFrequencyLow-Fault	Delayed Grid Frequency Low Fault.			X		C
0x3142	5395	GridFrequencyLowWarning	Grid Frequency Low Warning.		X			
0x3211	4144	DC-link Voltage High 2	The voltage of the DC link is above the normal operating range. Can be caused by too fast motor braking or grid transients. Increase deceleration time, enable the overvoltage controller, use AC brake, or use a brake resistor while braking.		X	X		C
0x3212	4145	DC-link Voltage High 1	The voltage of the DC link is above the normal operating range and has reached a critical level. Can be caused by too fast motor braking or grid transients. Increase deceleration time, enable the overvoltage controller, use AC brake, or use a brake resistor while braking.		X	X		C
0x3221	4146	DC-link Voltage Low	The DC-link voltage is below the normal operating range. Try to enable undervoltage protection to keep the drive running as long as possible.		X	X		C
0x32FF	4147	DC-link Voltage Ripple	Excessive voltage ripple has been detected on the main DC-link capacitors. This can be caused by an imbalance of the grid. Reduce the output power.		X	X		C

Table 30: Summary Table *(continued)*

Group Number (Hex)	Number (Decimal)	Display Name	Description	Type of Event				Converter Action
				I	W	F	PF	
0x32FF	4148	DC-link Imbalance	An imbalance across the DC-link capacitors is detected. The imbalance can be caused by a component fault of the DC link. If the fault remains after resetting the drive, service is required.		X	X		C
0x4110	4099	Ambient Temp. High	The ambient temperature is too high. Check the temperature and cooling conditions. Lower the temperature or improve the cooling conditions.		X			
0x4210	4107	Brake Chopper Temp. Limit	The temperatute of the brake chopper heat sink is at the upper limit of the normal temperature range. Check cooling and heat sink conditions. Reduce the generated regenerative power.		X			
0x4210	4108	Brake Chopper Temp. High 1	The temperature of the brake chopper heat sink has exceeded the normal temperature range. Check cooling and heat sink conditions. Reduce the generated regenerative power.		X	X		C
0x4210	4109	Brake Chopper Temp. High 2	The temperature of the brake chopper heat sink has reached a critical level. Check cooling and heat sink conditions. Reduce the generated regenerative power.		X	X		C
0x4220	4106	Brake Chopper Temp. Low	The temperature of the brake chopper heat sink is too low. Check the ambient temperature. Increase the ambient temperature or consider an external heater to increase the temperature around the drive.		X	X		C
0x4280	5132	Temp. Protection 1	Temperature protection 1 is triggered. The temperature has exceeded the configured value.		X	X		RC
0x4280	5133	Temp. Protection 2	Temperature protection 2 is triggered. The temperature has exceeded the configured value.		X	X		RC
0x4280	5134				X	X		RC
0x4280	5135	Temp. Protection 4	Temperature protection 4 is triggered. The temperature has exceeded the configured value.		X	X		RC
0x4280	5136	Temp. Protection 5	Temperature protection 5 is triggered. The temperature has exceeded the configured value.		X	X		RC
0x4280	5137	Temp. Protection 6	Temperature protection 6 is triggered. The temperature has exceeded the configured value.		X	X		RC

Table 30: Summary Table *(continued)*

Group Number (Hex)	Number (Decimal)	Display Name	Description	Type of Event				Converter Action
				I	W	F	PF	
0x4280	5138				X			
0x4280	5147	Temp. Protection 7	Temperature protection 7 is triggered. The temperature has exceeded the configured value.		X	X		RC
0x4280	5148	Temp. Protection 8	Temperature protection 8 is triggered. The temperature has exceeded the configured value.		X	X		RC
0x4280	5149	Temp. Protection 9	Temperature protection 9 is triggered. The temperature has exceeded the configured value.		X	X		RC
0x4280	5154	Temp. Protection 10	Temperature protection 10 is triggered. The temperature has exceeded the configured value.		X	X		RC
0x4281	5143	Thermistor Monitor 1	The input of thermistor monitor 1 has exceeded the 4 kilo ohm threshold.			X		C
0x4281	5144	Thermistor Monitor 2	The input of thermistor monitor 2 has exceeded the 4 kilo ohm threshold.			X		C
0x4281	5145	Thermistor Monitor 3	The input of thermistor monitor 3 has exceeded the 4 kilo ohm threshold.			X		C
0x42FF	4200	Power Option Temp. High 1	The temperature of a power option has exceeded the normal temperature range. Check the cooling conditions. Reduce the load or the ambient temperature.		X	X		RC
0x42FF	4201	Power Option Temp. High 2	The temperature of a power option has reached a critical level. Check the cooling conditions. Reduce the load or the ambient temperature.		X	X		RC
0x42FF	4202	Power Option Temp. Low	The temperature of a power option component is to low. Check the ambient temperature. Increase the ambient temperature or consider an external heater to increase the temperature around the power option.		X	X		RC
0x42FF	4203	Power Option Temp. Limit	The temperature of a power option component is at the upper limit of the normal temperature. Check the cooling conditions. Reduce the load or the ambient temperature.		X			
0x42FF	4204	Power Option Temp. Imbal. 1	The thermal imbalance between the power option components exceeds the normal operating range.		X	X		RC

Table 30: Summary Table *(continued)*

Group Number (Hex)	Number (Decimal)	Display Name	Description	Type of Event				Converter Action
				I	W	F	PF	
0x42FF	4205	Power Option Temp. Imbal. 2	An excessive thermal imbalance between power option components has been detected.		X	X		RC
0x42FF	4206	Power Option Temp. Imbal. Limit	The thermal imbalance between the power option components is at the upper limit of the normal operating range.		X			
0x4310	4103	Inverter Temp. Limit	The temperature of the inverter heat sink is at the upper limit of the normal temperature range. Check cooling and heat sink conditions. Reduce the output current or ambient temperature. The drive may derate if the temperature is not lowered.		X			
0x4310	4104	Inverter Temp. High 1	The temperature of the inverter heat sink has exceeded the normal temperature level. Check cooling and heat sink conditions. Reduce the output current or ambient temperature.		X	X		C
0x4310	4105	Inverter Temp. High 2	The temperature of the inverter heat sink has reached a critical level. Check cooling and heat sink conditions. Reduce the output current to avoid a protected fault.		X	X		C
0x4310	4110	IGBT Temp. High	An inverter IGBT overtemperature has been detected. Reduce the ambient temperature, the output current and/or the switching frequency. Check the cooling and the condition of the heat sink.			X		C
0x4310	4113	Rectifier Temp. Limit	The temperature of the rectifier heat sink is at the upper limit of the normal temperature range. Check cooling and heat sink conditions. Reduce the output power (torque, speed) or the ambient temperature.		X			
0x4310	4114	Rectifier Temp. High 1	The temperature of the rectifier heat sink has exceeded the normal temperature range. Check cooling and heat sink conditions. Reduce the output power (torque, speed) or the ambient temperature.		X	X		C

Table 30: Summary Table *(continued)*

Group Number (Hex)	Number (Decimal)	Display Name	Description	Type of Event				Converter Action
				I	W	F	PF	
0x4310	4115	Rectifier Temp. High 2	The temperature of the rectifier heat sink has reached a critical level. Check cooling and heat sink conditions. Reduce the output power (torque, speed) or the ambient temperature.		X	X		C
0x4310	4117	Power Unit Temp. Limit	The internal air temperature of the drive is at the upper limit of the normal temperature range. Check cooling and heat sink conditions. Reduce the output power (torque, speed) or the ambient temperature.		X			
0x4310	4118	Power Unit Temp. High 1	The internal air temperature of the drive has exceeded its normal temperature range. Check cooling and heat sink conditions. Reduce the output power (torque, speed) or the ambient temperature.		X	X		C
0x4310	4119	Power Unit Temp. High 2	The internal air temperature of the drive has reached a critical value. Check cooling and heat sink conditions. Reduce the output power (torque, speed) or the ambient temperature.		X	X		C
0x4310	4125	IGBT Temp. High	An inverter IGBT temperature has reached a critical value. Reduce the drive's output current if possible to avoid a protected fault.			X		C
0x4320	4102	Ambient Temp. Low	The drive is operated at a too low ambient temperature. Check the ambient temperature. Increase the ambient temperature or consider an external heater to increase the temperature around the drive.		X	X		C
0x4320	4112	Rectifier Temp. Low	The temperature of the rectifier heat sink is too low. Check the ambient temperature. Increase the ambient temperature or consider an external heater to increase the temperature around the drive.		X	X		C
0x4320	4116	Power Unit Temp. Low	The internal air temperature of the drive is below the normal operating range. The drive is operated at a too low ambient temperature. Consider an external heater to avoid this warning or fault.		X	X		C
0x4380	5240	Cooling Monitor	The cooling signal is missing.		X	X		C

Table 30: Summary Table *(continued)*

Group Number (Hex)	Number (Decimal)	Display Name	Description	Type of Event				Converter Action
				I	W	F	PF	
0x43FE	4120	Control Board Temp. Low	The temperature of the control board is below the normal temperature range. The drive is operated at a too low ambient temperature. Check the ambient temperature. Increase the ambient temperature or consider an external heater to increase the temperature at the drive.		X	X		C
0x43FE	4121	Control Board Temp. Limit	The temperature of the control board is at the upper limit of the normal temperature range. Check cooling conditions and load of the control board. Reduce the load on the control board or the ambient temperature.		X			
0x43FE	4122	Control Board Temp. High 1	The temperature of the control board has exceeded its normal temperature range. Check cooling conditions and load of the control board. Reduce the load on the control board or the ambient temperature.		X	X		C
0x43FE	4123	Control Board Temp. High 2	The temperature of the control board has reached a critical level. Check cooling conditions and load of the control board. Reduce the load on the control board or the ambient temperature.		X	X		C
0x43FF	4124	Break Chopper Temperature Imbalance	There is a temperature imbalance between 1 or more brake chopper IGBT's.		X			
0x43FF	4126	IGBT Temperature Imbalance	There is a temperature imbalance between 1 or more IGBT's.		X			
0x43FF	4127	IGBT Temperature Imbalance	An excessive thermal imbalance between the IGBT modules has been detected. Check the condition of IGBT modules their connections the cooling and the driver boards.		X			
0x43FF	4131	Temperature Imbalance Brake IGBT	There is a temperature imbalance between 1 or more brake chopper IGBT's.		X	X		C
0x43FF	4132	IGBT temperature delta	There is a temperature imbalance between 1 or more IGBT's.		X	X		C
0x5100	4641	24V Backup Mode	The drive is in 24V backup mode. The control section (including parameter configurations) and installed options are kept operational.	X				

Table 30: Summary Table *(continued)*

Group Number (Hex)	Number (Decimal)	Display Name	Description	Type of Event				Converter Action
				I	W	F	PF	
0x5112	4640	24V Supply Fault	The 24V supply is outside its normal operating range.				X	C
0x5114	4642	3.3V Supply Low	The voltage of the internal 3.3V supply is below its normal operating range.			X		C
0x5118	4643	28V Supply Low	The voltage of the internal 28V supply is below its normal operating range.			X		C
0x51FE	4644	Gate Driver Voltage Fault	The gate driver supply voltage is outside its normal operating range.				X	C
0x51FE	4653	Gate Driver Fault	A gate driver fault is detected or a link to the gate driver is broken.			X		C
0x51FF	4645	Power Board Supply Fault	A power supply fault on the power board has been detected.				X	C
0x51FF	4646	Power Supply Voltage	A power supply voltage is outside its normal operating range.				X	C
0x5210	4378	Current Sensor Fault	A defective current sensor or an error in the calibration of the current sensors has been detected.			X		C
0x54FD	4647	Function Disabled	The protection logic keeps the trip active until the configuration of the power unit protection levels is ready.			X		C
0x54FE	4628	STO Activated	The Safe Torque-Off (STO) is activated and an unintended restart is prevented until the STO-request has been reset.		X			C
0x54FE	4629	STO Fault Ch. A	The Safe Torque-Off (STO) is activated due to a discrepancy fault: Channel A is not activated, while channel B is activated.			X		C
0x54FE	4630	STO Fault Ch. B	The Safe Torque-Off (STO) is activated due to a discrepancy fault: Channel B is not activated, while channel A is activated.			X		C
0x54FF	4149	DC-link Short Circuit	An internal short circuit is detected in the DC link. Service is required.				X	C
0x54FF	4150	DC Capacitor Short Circuit	A short circuit in a DC-link capacitor is detected. Service is required.			X		C
0x54FF	4151	DC-link Short Circuit 2	A short circuit in the DC-link capacitor is detected. Service is required.	X			X	C

Table 30: Summary Table *(continued)*

Group Number (Hex)	Number (Decimal)	Display Name	Description	Type of Event				Converter Action
				I	W	F	PF	
0x5530	4790	Control Data Error	A data error is detected in the control data database EEPROM.	X				
0x5530	4791	Invalid PUD	A data error has been detected in the power unit database EEPROM.			X		C
0x6100	4304	License Missing	A required license is missing.		X			
0x6100	4349	Authenticity Error	Files authenticity verification error occurred.			X		RC
0x6100	4351	System Fault	A system fault has been detected. See additional information for details.			X		C
0x6100	4357					X		C
0x6100	4567	Restore Status	Provides information about the restore operation of a setting.	X				
0x6100	4816	PLC Task Overrun	The high CPU load is inhibiting normal operation of the application (PLC task overrun).		X			
0x6100	4817	PLC Runtime Error	The PLC runtime has stopped responding. The application has been halted.			X		C
0x6100	4832	Node Discovery	Node discovery and configuration are in progress. The modulation is inhibited.	X				RC
0x6100	4833	Node Commissioning	Nodes are being commissioned.		X			C
0x6100	4834	Node Missing	A previously commissioned node is no longer available. The drive is waiting for the node to be available. If the node has been removed, recommission the drive.	X				
0x6100	4853	StartupOccurrence	This event masks over various events that might be active during startup, that we dont want to show the end user	X				
0x6100	4854	ResetByDemand	Drive reset is requested by user, and will be performed shortly	X				C
0x6100	4855	Internal Fault	An internal fault has been detected. Cycle power, check the wiring if applicable, contact the service provider if the fault persists. Note the event number for further troubleshooting directions.			X		RC

Table 30: Summary Table *(continued)*

Group Number (Hex)	Number (Decimal)	Display Name	Description	Type of Event				Converter Action
				I	W	F	PF	
0x6100	4856	Internal Fault	An internal fault has been detected (connection from controller). Cycle power, check the internal wiring, contact the service provider if the fault persists. Note the event number for further troubleshooting directions.			X		C
0x6100	4857	Software Update	The drive is currently performing an update of the software.	X				
0x6100	5130	Quick Stop Active	Quick Stop exception active.			X		C
0x6180	5260	Event Simulation	The event with the number 5260 is simulated.		X	X		C
0x6181	4980	A Digital Input terminal is unknown by system	A digital input terminal has been selected that is unknown by system. Maybe an option has been moved or removed.		X			
0x6181	4981	A Digital Output terminal is unknown by system	A digital output terminal has been selected that is unknown by system. Maybe an option has been moved or removed.		X			
0x6181	4982	An Analog Input terminal is unknown by system	An analog input terminal has been selected that is unknown by system. Maybe an option has been moved or removed.		X			
0x6181	4983	An Analog Output terminal is unknown by system	An analog output terminal has been selected that is unknown by system. Maybe an option has been moved or removed.		X			
0x6181	4984	A Digital Output occupied	A digital output is in use by an other function or fieldbus. If a Fieldbus has taken control over a terminal, it has priority over parameter selection.		X			
0x6181	4985	An Analog Output occupied	An analog output is in use by an other function or fieldbus. If a Fieldbus has taken control over a terminal, it has priority over parameter selection.		X			
0x61F7	4800	Low Storage Space	The available storage space for the file system is low.	X				
0x61F7	4801	Data Logger Storage	Volume restriction limits are preventing additional data logger capture files from being stored.		X			
0x61F7	4802	Event Logger Storage	Volume restriction limits are preventing additional event log capture files from being stored.		X			

Table 30: Summary Table *(continued)*

Group Number (Hex)	Number (Decimal)	Display Name	Description	Type of Event				Converter Action
				I	W	F	PF	
0x61FB	4600	Option Communication Fault	A fault of the communication with an option has been detected. Cycle power, check that the option is properly installed, contact the Danfoss supplier or the service department if the fault persists. Note the event number for further troubleshooting directions.			X		RC
0x61FB	4601	Internal Communication Fault	An internal communication fault has been detected. Cycle power, check the wiring if applicable, contact the service provider if the fault persists. Note the event number for further troubleshooting directions.		X			
0x61FB	4602	Option Communication Fault	A fault of the communication with an option has been detected. Cycle power, check that the option is properly installed, contact the Danfoss supplier or the service department if the fault persists. Note the event number for further troubleshooting directions.			X		C
0x61FB	4607	Internal Communication Fault	An internal communication fault has been detected. Cycle power, check the wiring if applicable, contact the Danfoss supplier or the service department if the fault persists. Note the occurrence number for further troubleshooting directions.			X		C
0x61FB	4631	Internal Communication Fault	An internal communication fault has been detected. Cycle power, check the wiring if applicable, contact the Danfoss supplier or the service department if the fault persists. Note the occurrence number for further troubleshooting directions.			X		RC
0x61FB	4632	Internal Communication Fault	An internal communication fault has been detected. Cycle power, check the wiring if applicable, contact the service provider if the fault persists. Note the event number for further troubleshooting directions.		X			

Table 30: Summary Table *(continued)*

Group Number (Hex)	Number (Decimal)	Display Name	Description	Type of Event				Converter Action
				I	W	F	PF	
0x61FC	4605	Internal Communication Fault	An internal communication fault has been detected. Cycle power, check the wiring if applicable, contact the service provider if the fault persists. Note the event number for further troubleshooting directions.			X		C
0x61FC	4606	Internal Communication Fault	An internal communication fault has been detected. Cycle power, check the wiring if applicable, contact the Danfoss supplier or the service department if the fault persists. Note the occurrence number for further troubleshooting directions.			X		C
0x61FC	4639	High Speed Bus Sync Error	Internal error detected with high-speed bus connection to parallel control unit.			X		C
0x61FC	4648	High Speed Bus Error	Internal error detected with high-speed bus connection to parallel control unit.			X		C
0x61FC	4858	Internal Fault	An internal fault has been detected. The power system has not received the required reference for modulation. Cycle power, check the wiring if applicable, contact the Danfoss supplier or the service department if the fault persists. Note the event number for further troubleshooting directions.		X	X		C
0x61FC	4859	Internal Fault	An internal fault (connection from power system) has been detected. Cycle power, check the internal wiring, contact the service provider if the fault persists. Note the event number for further troubleshooting directions.		X	X		C
0x61FC	4860	Unexpected Time Adjust	An internal fault (unexpected time adjustment) has been detected. Cycle power, check the internal wiring, contact the service provider if the fault persists. Note the event number for further troubleshooting directions.			X		C

Table 30: Summary Table *(continued)*

Group Number (Hex)	Number (Decimal)	Display Name	Description	Type of Event				Converter Action
				I	W	F	PF	
0x61FC	4861	Synchronization Fault	An internal fault (time synchronization error between controller and power system) has been detected. Cycle power, check the internal wiring, contact the service provider if the fault persists. Note the event number for further troubleshooting directions.			X		C
0x61FC	4862	PDS	Internal error detected with high-speed bus connection from controller.			X		C
0x61FC	4863	Internal Fault	An internal fault (connection with power system) has been detected. Cycle power, check the internal wiring, contact the service provider if the fault persists. Note the event number for further troubleshooting directions.			X		C
0x6320	4350	Configuration Error	An invalid system configuration has been detected.		X	X		C
0x7082	5376	MainCircuitBreakerFeedback	Main circuit breaker feedback excecption.			X		C
0x7082	5377	MainCircuitBreakerFeedbackConflict	Mcb open and closed dig inputs in conflict state.		X			
0x7082	5378	MainCircuitBreakerTripped	Main circuit breaker tripped excecption.			X		C
0x70FF	4128	Control Fan Failure	The control board cooling fan is not running at the commanded speed.		X			
0x70FF	4129	Main Fan Failure	The main cooling fan is not following its reference speed. Check the fan's wiring and whether its blocked or polluted. Replace the fan if necessary.		X			
0x70FF	4130	Internal Fan Failure	The internal fan is running below its reference speed. Check the fan's wiring and whether its blocked or polluted. Replace the fan if necessary.		X			
0x70FF	4133	LCL Fan Speed Fault	LCL cooling fan not tracking commanded output.			X		C
0x7111	4403	Brake Ch. Switch Shorted	A short circuit of the brake chopper switch has been detected, which can be dangerous. Disconnect power. Service is required.		X	X		C

Table 30: Summary Table *(continued)*

Group Number (Hex)	Number (Decimal)	Display Name	Description	Type of Event				Converter Action
				I	W	F	PF	
0x7113	4400	Brake Chopper Overload	A brake chopper overcurrent has been detected. Reduce the brake voltage level and check the rating of the brake resistor.		X		X	C
0x7113	4401	Brake Resistor Temp. High	The brake resistor temperature is too high. Check the rating of the brake resistor and cooling conditions. Reduce the generated regenerative power.		X	X		C
0x7113	4402	Brake Resistor Missing	The brake resistor or its connection is missing.		X	X		C
0x7113	4404	Brake Failure	A brake failure is detected, further testing will clarify the failure source. Coast first to run the test.		X			C
0x7120	4177	Motor Thermal Overload	A thermal overload of the motor has been detected. Check if the shaft torque is too high.		X	X		C
0x7120	4178	Motor Speed High	The motor speed is above the normal operating range.		X	X		C
0x7120	4179	AMA Current Low	The nominal current of the motor is too low for accurate results of automatic motor adaptation (AMA).		X			
0x7120	4180	Rotor Angle Detection Error	Rotor angle detection has failed. This might be as the motor is not suited to the drive or the motor is missing.		X	X		C
0x7120	4181	Low Motor Saliency For High Frequency Injection Mode	Motor saliency is too low for HF injection mode.		X	X		C
0x7122	4182	Motor Sync Loss	Select the drive response if synchronization between motor and drive is lost. This is only used when using a permanent magnet or synchronous reluctance motor.		X	X		C
0x7180	5250	Filter energization failure.	Filter energization timed out.			X		C
0x7180	5380	PreChargeFailed	Pre charge failed.			X		C
0x7180	5381	ExternalPreChargeFailed	Pre charge failed.			X		C
0x72FF	4417	Feedback Option Fault	The Feedback Option is indicating a fault condition.			X		C
0x7310	4418	Bad Speed Feedback	Speed Feedback value is not reliable.			X		C

Table 30: Summary Table *(continued)*

Group Number (Hex)	Number (Decimal)	Display Name	Description	Type of Event				Converter Action
				I	W	F	PF	
0x7500	4638	Drive to Drive Connection Lost	Drive to drive connection is lost.		X	X		C
0x7580	5141	Control Panel Connection Lost	The connection to the control panel was lost. Panel control has been released.					
0x7580	5142	PC Tool Connection Lost	The connection to the PC tool was lost. PC control has been released.					
0x8080	5160	Limit Supervision	Selected signal is over/under of supervision limit.			X		C
0x8100	4256	Address Conflict	The fieldbus has identified an Address Conflict on the network which made the device back off.		X			
0x8100	4257	Ethernet Cable Fault	At link down a measurement is done to measure the distance to the far end of the cable, indicating where the fault has occurred. This warning occurs at distances > 4 m and Link State Change Down. Actual distance shown in detailed info.		X			
0x8100	4258	Invalid Fieldbus Configuration	An issue due to an invalid configuration of the fieldbus connection has been detected. Features not supported by the device, mismatch between configured and actually available features or modules not available in the device. See additional detail info.	X				
0x8100	4260	Redundant Controller Missing	One or more of the expected fieldbus controllers are missing.		X			
0x8100	4261	Fieldbus Topology Mismatch	The current fieldbus topology does not match the topology provided at commissioning time.		X			
0x8100	4263	Ethernet Link Status Changed	There has been detected a change of the Ethernet link status. Additional info has details about which port and state.	X				
0x8100	4265	Ethernet Redundancy Error	Primary or backup physical paths has been detected missing.		X			
0x8100	4266	X1 Cable Redundancy	Indicates that physical path from X1 interface to the controller is missing or wrongly configured.		X			
0x8100	4267	X2 Cable Redundancy	Indicates that physical path from X2 interface to the controller is missing or wrongly configured.		X			
0x8100	4268	FieldbusStartUp	Internal event to mask away TopologyMis- match event during startup	X				

Table 30: Summary Table *(continued)*

Group Number (Hex)	Number (Decimal)	Display Name	Description	Type of Event				Converter Action
				I	W	F	PF	
0x8100	4269	Network Time Protocol	Information of Network Time Protocol server. See detailed info.	X				
0x8100	4280	Controller Not in Run	Controller not in RUN state.	X				
0x8100	4281	Interface Configuration Change	Interface configuration changed. See detailed info.	X				
0x8100	5161	Fieldbus Watchdog Supervision	Fieldbus watchdog supervision has detected too long delay between fieldbus data updates.					
0x81FD	4270			X				
0x81FD	4271			X				
0x81FD	4272			X				
0x81FD	4273	No EtherCAT Connection	No EtherCAT communication is currently established. Will happen during start-up until first connection is established. Or if all connections has stopped (gracefully or disruptive).	X				
0x81FD	4282	No Modbus TCP Connection	No Modbus RTU communication is currently established. Occurs during start-up until first connection is established, or if all connections has stopped (gracefully or disruptive).	X				
0x81FE	4274				X			
0x81FE	4275				X			
0x81FE	4276				X			
0x81FE	4277	Loss of EtherCAT Connection	One or more of the fieldbus I/O connections has failed. This can happen when an established fieldbus I/O Connection has been disrupted by e.g cable break or powercut of PLC or other infrastructure components.		X			
0x81FE	4283	Loss of Modbus RTU Connection	One or more of the fieldbus I/O connections has failed. This can happen when an established fieldbus I/O connection has been disrupted by for example cable break or powercut of PLC or other infrastructure components.		X			
0x81FF	4278					X		C

Table 30: Summary Table *(continued)*

Group Number (Hex)	Number (Decimal)	Display Name	Description	Type of Event				Converter Action
				I	W	F	PF	
0x81FF	4279	Secondary Process Data Timeout	The fieldbus I/O Data has not been updating any of the process data monitored by the secondary process data monitor (Watchdog2). This can happen when the fieldbus has lost control or the current transferred I/O data is not valid.			X		C
0x8611	4192	Position Following Error	The actual position is outside the allowed range of the position error window around a position demand value for longer than the position error delay.		X			
0x8612	4193	Position Limit	Motor position is outside the allowed range [PositionMin, PositionMax].		X	X		C
0x8612	4194	Position Command Rejected	Position command was rejected because of position software end limit.		X			
0x8612	4195	Hardware End Limit	The positioning controller detected that the drive is exceeding the hardware end Limits.		X	X		C
0xFF01	5123	External Exception 1	External Exception 1.			X		C
0xFF01	5124	External Exception 2	External Exception 2.			X		C

8.5 Troubleshooting of Events

This section covers the faults and warnings that can occur while the application software is running on the drive. Possible causes and remedies are given for each event.

Event Type, 0x2120-4352 (8480–4352)

NOTICE

EVENT NAME: IEARTH0

Reason: High-impedance ground fault has occurred as ground leakage is detected.

- Cause: Insulation failure.
- Remedy: Inspect connections and cables.

Event Type, 0x2120-4353 (8480–4353)

NOTICE

EVENT NAME: IEARTH1

Reason: Ground fault has occurred in the drive as ground leakage is detected.

- Cause: Insulation failure.
- Remedy: Inspect connections and cables.

Event Type, 0x2120-4354 (8480–4354)

NOTICE

EVENT NAME: IEARTH1

Reason: Low impedance ground fault has occurred in the drive as ground leakage is detected.

- Cause: Insulation failure.
- Remedy: Inspect connections and cables.

Event Type, 0x2130-4356 (8496–4356)

NOTICE

EVENT NAME: DESAT

Reason: Short circuit is detected in the output of the drive. Gate driver desaturation error has occurred.

- Cause: Short circuit detected.
- Remedy: Fix the short circuit by checking, replacing, or isolating wires.

Event Type, 0x2130-4370 (8496–4370)

NOTICE

EVENT NAME: I_{MAX2}

Reason: Inverter output short circuit is detected.

- Cause: Short circuit detected.
- Remedy: Fix the short circuit by checking, replacing, or isolating wires.

Event Type, 0x2180-4372 (8576–4372)

NOTICE

EVENT NAME: SHORT TERM CURRENT INJECTION

Reason: Drive has operated against short term current injection limit for more than the allowed short term current injection time.

The fault is only applicable when Grid Converter operates in micro grid control mode.

- Cause: Short circuit detected.
- Remedy: Fix the short circuit by checking, replacing, or isolating wires.
- Cause: The allowed time is short for current injection in the short circuit.
- Remedy: Increase the short circuit current injection time.
- Cause: External Voltage feedback option is disabled.
- Remedy: Enable external voltage feedback option.

Event Type, 0x2311-4097 (8977–4097)

NOTICE

EVENT NAME: INVERTERTHERMAL

Reason: Inverter thermal overload is detected.

- Cause: Sudden change in grid frequency or in grid voltage.
- Remedy: Inspect the grid load.
- Cause: Incorrect configuration of LCL filter parameters.
- Remedy: Verify the configuration of LCL filter parameters in Menu Index 3.6 of the standard iC7 application software.
- Cause: Sudden change in DC load while using DC/DC Converter.
- Remedy: Inspect DC load.

Event Type, 0x2311-4369 (8977–4369)

NOTICE

EVENT NAME: I_{MAX1}

Reason: A continuous inverter output overcurrent is detected.

- Cause: Sudden change in grid frequency or in grid voltage.
- Remedy: Inspect the grid load.
- Cause: Incorrect configuration of LCL filter parameters.
- Remedy: Verify the configuration of LCL filter parameters in Menu Index 3.6 of the standard iC7 application software.
- Cause: Sudden change in DC load while using DC/DC Converter.
- Remedy: Inspect DC load.

Event Type, 0x2311-4376 (8977–4376)

NOTICE

EVENT NAME: ILIMITZEROSPEED

Reason: Excessive current output at low modulation frequency is detected. Issuing of the fault protects the drive against operating with high current at very low speed for a sustained period of time.

- Cause: Sudden change in grid frequency or in grid voltage.
- Remedy: Inspect the grid load.
- Cause: Incorrect configuration of LCL filter parameters.
- Remedy: Verify the configuration of LCL filter parameters in Menu Index 3.6 of the standard iC7 application software.
- Cause: Sudden change in DC load while using DC/DC Converter.
- Remedy: Inspect DC load.

Event Type, 0x2311-4380 (8977–4380)

NOTICE

EVENT NAME: CONSTCONFREQDERATING

Reason: The detected current is very high relative to the selected switching frequency.

- Cause: Sudden change in grid frequency or in grid voltage.
- Remedy: Inspect the grid load.
- Cause: Incorrect configuration of LCL filter parameters.
- Remedy: Verify the configuration of LCL filter parameters in Menu Index 3.6 of the standard iC7 application software.
- Cause: Sudden change in DC load while using DC/DC Converter.
- Remedy: Inspect DC load.

Event Type, 0x2311-4386 (8977–4386)

NOTICE

EVENT NAME: I_{MAX0}

Reason: A continuous inverter output overcurrent is detected.

- Cause: Sudden change in grid frequency or in grid voltage.
- Remedy: Inspect the grid load.
- Cause: Incorrect configuration of LCL filter parameters.
- Remedy: Verify the configuration of LCL filter parameters in Menu Index 3.6 of the standard iC7 application software.
- Cause: Sudden change in DC load while using DC/DC Converter.
- Remedy: Inspect DC load.

Event Type, 0x3110-4164 (12560–4164)

NOTICE

EVENT NAME: LINERMSOVERVOLTAGE

Reason: Grid voltage is outside of voltage supervision limits.

- Cause: A short circuit has occurred in the grid.
- Remedy: Fix the short circuit.
- Cause: Voltage reference is below the set limits.
- Remedy: Check grid voltage references.
- Cause: Incorrect configuration of supervision limits, so that they are very high or low.
- Remedy: Check the grid supervision limits or reset to default.
- Cause: Incorrect configuration of voltage droop control parameters.
- Remedy: Check voltage droop control parameters and reset to default.
- Cause: The external voltage measurement option is not operating.
- Remedy: Check the external voltage measurement board connections and board quality. Replace with a new external voltage measurement board or connections.

Event Type, 0x3110-5392 (12560–5392)

NOTICE

EVENT NAME: GRID OVERVOLTAGE DELAYED FAULT

Reason: Grid voltage is outside of voltage supervision limits.

- Cause: A short circuit has occurred in the grid.
- Remedy: Fix the short circuit.
- Cause: Voltage reference is below the set limits.
- Remedy: Check grid voltage references.
- Cause: Incorrect configuration of supervision limits, so that they are very high or low.
- Remedy: Check the grid supervision limits or reset to default.
- Cause: Incorrect configuration of voltage droop control parameters.
- Remedy: Check voltage droop control parameters and reset to default.
- Cause: The external voltage measurement option is not operating.
- Remedy: Check the external voltage measurement board connections and board quality. Replace with a new external voltage measurement board or connections.

Event Type, 0x3110-5396 (12560–5396)

NOTICE

EVENT NAME: GRID OVERVOLTAGE WARNING

Reason: Grid voltage is outside of voltage supervision limits.

- Cause: A short circuit has occurred in the grid.
- Remedy: Fix the short circuit.
- Cause: Voltage reference is below the set limits.
- Remedy: Check grid voltage references.
- Cause: Incorrect configuration of supervision limits, so that they are very high or low.
- Remedy: Check the grid supervision limits or reset to default.
- Cause: Incorrect configuration of voltage droop control parameters.
- Remedy: Check voltage droop control parameters and reset to default.
- Cause: The external voltage measurement option is not operating.
- Remedy: Check the external voltage measurement board connections and board quality. Replace with a new external voltage measurement board or connections.

Event Type, 0x3120-4165 (12576–5396)

NOTICE

EVENT NAME: LINERMSUNDERVOLTAGE

Reason: Grid voltage is outside of voltage supervision limits.

- Cause: A short circuit has occurred in the grid.
- Remedy: Fix the short circuit.
- Cause: Voltage reference is below the set limits.
- Remedy: Check grid voltage references.
- Cause: Incorrect configuration of supervision limits, so that they are very high or low.
- Remedy: Check the grid supervision limits or reset to default.
- Cause: Incorrect configuration of voltage droop control parameters.
- Remedy: Check voltage droop control parameters and reset to default.
- Cause: The external voltage measurement option is not operating.
- Remedy: Check the external voltage measurement board connections and board quality. Replace with a new external voltage measurement board or connections.

Event Type, 0x3120-4167 (12576–4167)

NOTICE

EVENT NAME: LINERMSVOLTAGEWARNING

Reason: Grid voltage is outside of voltage supervision limits.

- Cause: A short circuit has occurred in the grid.
- Remedy: Fix the short circuit.
- Cause: Voltage reference is below the set limits.
- Remedy: Check grid voltage references.
- Cause: Incorrect configuration of supervision limits, so that they are very high or low.
- Remedy: Check the grid supervision limits or reset to default.
- Cause: Incorrect configuration of voltage droop control parameters.
- Remedy: Check voltage droop control parameters and reset to default.
- Cause: The external voltage measurement option is not operating.
- Remedy: Check the external voltage measurement board connections and board quality. Replace with a new external voltage measurement board or connections.

Event Type, 0x3120-5393 (12576–5393)

NOTICE

EVENT NAME: GRID UNDERVOLTAGE DELAYED FAULT

Reason: Grid voltage is outside of voltage supervision limits.

- Cause: A short circuit has occurred in the grid.
- Remedy: Fix the short circuit.
- Cause: Voltage reference is below the set limits.
- Remedy: Check grid voltage references.
- Cause: Incorrect configuration of supervision limits, so that they are very high or low.
- Remedy: Check the grid supervision limits or reset to default.
- Cause: Incorrect configuration of voltage droop control parameters.
- Remedy: Check voltage droop control parameters and reset to default.
- Cause: The external voltage measurement option is not operating.
- Remedy: Check the external voltage measurement board connections and board quality. Replace with a new external voltage measurement board or connections.

Event Type, 0x3120-5397 (12576–5397)

NOTICE

EVENT NAME: GRID UNDERVOLTAGE WARNING

Reason: Grid voltage is outside of voltage supervision limits.

- Cause: A short circuit has occurred in the grid.
- Remedy: Fix the short circuit.
- Cause: Voltage reference is below the set limits.
- Remedy: Check grid voltage references.
- Cause: Incorrect configuration of supervision limits, so that they are very high or low.
- Remedy: Check the grid supervision limits or reset to default.
- Cause: Incorrect configuration of voltage droop control parameters.
- Remedy: Check voltage droop control parameters and reset to default.
- Cause: The external voltage measurement option is not operating.
- Remedy: Check the external voltage measurement board connections and board quality. Replace with a new external voltage measurement board or connections.

Event Type, 0x3130-4160 (12592–4160)

NOTICE

EVENT NAME: MISSINGLINE

The drive cannot synchronize to the grid frequency.

- Cause: Missing input line phase.
- Remedy: Check supply voltage, fuses, and cables.
- Cause: Grid cannot be synchronized.
- Remedy: Check drive dimensions with the grid power requirements.
- Cause: Very low power or current limits for the active load.
- Remedy: Check whether the power or current limits are sufficient.

Event Type, 0x3140-4161 (12608–4161)

NOTICE

EVENT NAME: LINEFREQUENCY

The drive cannot synchronize to the grid frequency.

- Cause: Missing input line phase.
- Remedy: Check supply voltage, fuses, and cables.
- Cause: Grid cannot be synchronized.
- Remedy: Check drive dimensions with the grid power requirements.
- Cause: Very low power or current limits for the active load.
- Remedy: Check whether the power or current limits are sufficient.
- Cause: Grid frequency is outside normal operating range.
- Remedy: Verify the normal operating range defined in parameters ***High Freq. Instant Fault Limit (P2840)*** and ***Low Freq. Instant Fault Limit (P2841)***.

Event Type, 0x3141-5390 (12609–5390)

NOTICE

EVENT NAME: LINEFREQUENCY

Grid voltage is outside out of voltage supervision limits.

- Cause: Short circuit has occurred in the grid.
- Remedy: Fix short circuit.
- Cause: Voltage reference is below the set limits.
- Remedy: Check grid voltage references.
- Cause: Incorrect configuration of supervision limits, so that they are very high or low.
- Remedy: Check the grid supervision limits or reset to default.
- Cause: Incorrect configuration of voltage droop control parameters.
- Remedy: Check voltage droop control parameters and reset to default.
- Cause: The external voltage measurement option is not operating.
- Remedy: Check the external voltage measurement board connections and board quality. Replace with a new external voltage measurement board or connections.

Event Type, 0x3142-5391 (12610–5391)

NOTICE

EVENT NAME: DELAYED GRID FREQUENCY LOW FAULT

Grid voltage is outside out of voltage supervision limits.

- Cause: Short circuit has occurred in the grid.
- Remedy: Fix short circuit.
- Cause: Voltage reference is below the set limits.
- Remedy: Check grid voltage references.
- Cause: Incorrect configuration of supervision limits, so that they are very high or low.
- Remedy: Check the grid supervision limits or reset to default.
- Cause: Incorrect configuration of voltage droop control parameters.
- Remedy: Check voltage droop control parameters and reset to default.
- Cause: The external voltage measurement option is not operating.
- Remedy: Check the external voltage measurement board connections and board quality. Replace with a new external voltage measurement board or connections.

Fault, 0x3142-5395 (12610–5395)

NOTICE

EVENT NAME: DELAYED GRID FREQUENCY LOW FAULT

Grid voltage is outside out of voltage supervision limits.

- Cause: Short circuit has occurred in the grid.
- Remedy: Fix short circuit.
- Cause: Voltage reference is below the set limits.
- Remedy: Check grid voltage references.
- Cause: Incorrect configuration of supervision limits, so that they are very high or low.
- Remedy: Check the grid supervision limits or reset to default.
- Cause: Incorrect configuration of voltage droop control parameters.
- Remedy: Check voltage droop control parameters and reset to default.
- Cause: The external voltage measurement option is not operating.
- Remedy: Check the external voltage measurement board connections and board quality. Replace with a new external voltage measurement board or connections.

Event Type, 0x3182-4166 (12674–4166)

NOTICE

EVENT NAME: LINEPLLLOCK

Reason: The drive cannot synchronize to the grid frequency.

- Cause: Missing input line phase.
- Remedy: Check supply voltage, fuses, and cables.
- Cause: Grid cannot be synchronized.
- Remedy: Check drive dimensions with the grid power requirements.
- Cause: Very low power or current limits for the active load.
- Remedy: Check whether the power or current limits are sufficient.
- Cause: Unable to maintain PLL lock on grid frequency.
- Remedy:

Event Type, 0x3211-4144 (12817–4144)

NOTICE

EVENT NAME: UDCOVERVOLT

Reason: The DC-link voltage has exceeded the normal operating range.

- Cause: Sudden change in supply voltage or frequency.
- Remedy: Check supply voltage or frequency.
- Cause: High overvoltage spikes in supply voltage.
- Remedy: Activate the overvoltage controller.
- Cause: A continuous high DC-link voltage.
- Remedy: Inspect the voltage supply.
- Cause: Unstable DC power source in micro grid mode.
- Remedy: Check DC source.
- Cause: Incorrect grid frequency.
- Remedy: Check grid conditions.

Event Type, 0x3211-4144 (12817–4144)

NOTICE

EVENT NAME: UDCOVERVOLTSLOW

Reason: The DC-link voltage has exceeded the normal operating range.

- Cause: Sudden change in supply voltage or frequency.
- Remedy: Check supply voltage or frequency.
- Cause: High overvoltage spikes in supply voltage.
- Remedy: Activate the overvoltage controller.
- Cause: A continuous high DC-link voltage.
- Remedy: Inspect the voltage supply.
- Cause: Unstable DC power source in micro grid mode.
- Remedy: Check DC source.
- Cause: Incorrect grid frequency.
- Remedy: Check grid conditions.

Event Type, 0x3221-4146 (12833–4146)

NOTICE

EVENT NAME: UDCUNDERVOLT

Reason: The DC-link voltage is below normal operating range.

- Cause: Too low supply voltage or limited supply power.
- Remedy: Inspect the voltage supply.
- Cause: An internal fault is detected in the device.
- Remedy: Inspect the device.
- Cause: Probability of a blown input fuse.
- Remedy: Inspect the fuses.
- Cause: External charge switch is not closed.
- Remedy: Inspect the charge switch.

Event Type, 0x4210-4103 (16912–4103)

NOTICE

EVENT NAME: TLIMITM

Reason: IGBT temperature above normal operating range is detected.

- Cause: Very high load is detected.
- Remedy: Inspect high load.
- Cause: Coolant temperature is very high or insufficient coolant flow.
- Remedy: Inspect the cooling unit.

Event Type, 0x4210-4104 (16912–4104)

NOTICE

EVENT NAME: TMAX1M

Reason: IGBT temperature above normal operating range is detected.

- Cause: Very high load is detected.
- Remedy: Inspect high load.
- Cause: Coolant temperature is very high or insufficient coolant flow.
- Remedy: Inspect the cooling unit.

Event Type, 0x4210-4110 (16912–4110)

NOTICE

EVENT NAME: IGBTMODELOVERTEMPFAULT

Reason: Overtemperature is detected in IGBT.

- Cause: Very high load is detected.
- Remedy: Inspect high load.
- Cause: Coolant temperature is very high or insufficient coolant flow.
- Remedy: Inspect the cooling unit.

Event Type, 0x4210-4125 (16912–4125)

NOTICE

EVENT NAME: IGBTOVERTEMPFAULT

Reason: Overtemperature is detected in IGBT.

- Cause: Very high load is detected.
- Remedy: Inspect high load.
- Cause: Coolant temperature is very high or insufficient coolant flow.
- Remedy: Inspect the cooling unit.

Event Type, 0x7500-5141 (29952–5142)

NOTICE

EVENT NAME: CONTROL PANEL CONNECTION LOSS

Reason: The drive has lost connection with the control panel, when local control is the active control place.

- Cause: Cable connection to the control panel is damaged or unplugged.
- Remedy: Replace damaged cable.
- Remedy: Replug the cable.
- Cause: Control unit HMI connector is damaged.
- Remedy: Replace the control unit.
- Cause: Control panel is damaged.
- Remedy: Replace the control panel.

Event Type, 0x7500-5142 (29952–5142)

NOTICE

EVENT NAME: PC TOOL CONNECTION LOSS

Reason: The drive has lost connection with the control panel, when local control is the active control place.

- Cause: Cable connection to the control panel is damaged or unplugged.
- Remedy: Replace damaged cable.
- Remedy: Replug the cable.
- Cause: Control unit HMI connector is damaged.
- Remedy: Replace the control unit.
- Cause: Control panel is damaged.
- Remedy: Replace the control panel.

Event Type, 0x7580-5120 (30080–5120)

NOTICE

EVENT NAME: FIELDBUS COMMUNICATION ERROR

Reason: Error is detected during fieldbus communication with the product.

- Cause: Fieldbus connection issues.
- Remedy: Inspect the fieldbus cabling and installation.
- Cause: Fieldbus master cannot be controlled.
- Remedy: Check the behavior of fieldbus master.

Event Type, 0x7580-5121 (30080–5121)

NOTICE

EVENT NAME: FIELDBUS WATCHDOG

Reason: A fault is issued as a change in the state of the watchdog bit in the fieldbus control word is not detected within the specified watchdog delay time.

- Cause: Fieldbus connection issues.
- Remedy: Inspect the fieldbus cabling and installation.
- Cause: Fieldbus master cannot be controlled.
- Remedy: Check the behavior of fieldbus master.
- Cause: Watchdog delay specified is too short.
- Remedy: Verify configuration of watchdog delay parameters.

Event Type, 0xFF03-5123 (65283–5123)

NOTICE

EVENT NAME: EXTERNAL EXCEPTION 1

Reason: External fault or warning is triggered by digital input.

- Cause: External fault or warning is triggered by digital input.
- Remedy: Verify the conditions which trigger the external fault or warning.

Event Type, 0xFF03-5124 (65283–5124)

NOTICE

EVENT NAME: EXTERNAL EXCEPTION 2

Reason: External fault or warning is triggered by digital input.

- Cause: External fault or warning is triggered by digital input.
- Remedy: Verify the conditions which trigger the external fault or warning.

Event Type, 0xFF09-5130 (65289–5130)

NOTICE

EVENT NAME: QUICK STOP EXCEPTION

Reason: Quick stop is triggered from digital input or fieldbus.

- Cause: Cable connection to the HMI is damaged or unplugged.
- Remedy: Replace damaged cable.
- Remedy: Replug the cable.
- Cause: Control unit HMI connector is damaged.
- Remedy: Replace the control unit.
- Cause: Control panel is damaged.
- Remedy: Replace the control panel.

Event Type, 0xFF0A-5377 (65290–5377)

NOTICE

EVENT NAME: PC TOOL CONNECTION LOSS

Reason: The converter has lost connection with the PC tool, when the PC tool is the active control place.

- Cause: Ethernet cable is not properly connected or is broken.
- Remedy: Check the Ethernet cable.

Event Type, 0xFF0A-5378 (65290–5378)

NOTICE

EVENT NAME: MAIN CIRCUIT BREAKER TRIPPED

Reason: Main circuit breaker trip digital input has caused the main circuit breaker to be opened.

- Cause: Main circuit breaker has opened because of the trip.
- Remedy: Identify the condition which caused the trip.

Event Type, 0xFF0A-5380 (65290–5380)

NOTICE

EVENT NAME: PRE-CHARGE FAILED

Reason: Drive has not reached the precharged state within the maximum allowed precharging time.

- Cause: Charging circuit is not operational.
- Remedy: Check the charging circuit and relay.
- Cause: High load on DC link.
- Remedy: Increase the maximum time to precharge the drive.
- Remedy: Remove unnecessary load on DC link.
- Cause: Voltage available in AC supply is low for charging circuit.
- Remedy: Measure AC supply voltage and verify if the supply voltage is within the specifications.

Event Type, 0xFF0B-5381 (65291–5381)

NOTICE

EVENT NAME: PRE-CHARGE FAILED

Reason: Drive has not reached the precharged state within the maximum allowed precharging time.

- Cause: Charging circuit is not operational.
- Remedy: Check the charging circuit and relay.
- Cause: High load on DC link.
- Remedy: Increase the maximum time to precharge the drive.
- Remedy: Remove unnecessary load on DC link.
- Cause: Voltage available in AC supply is low for charging circuit.
- Remedy: Measure AC supply voltage and verify if the supply voltage is within the specifications.

Event Type, 0x4210-4105 (16912–4105)

NOTICE

EVENT NAME: TMAX2M

Reason: IGBT temperature above normal operating range is detected.

- Cause: Very high load is detected.
- Remedy: Inspect high load.
- Cause: Coolant temperature is very high or insufficient coolant flow.
- Remedy: Inspect the cooling unit.

Event Type, 0x4210-5143 (16912–5143)

NOTICE

EVENT NAME: TEMPERATURE PROTECTION 1

Reason: Thermistor has triggered a high temperature fault or warning.

- Cause: Device connected to thermistor is overheated.
- Remedy: Check the device temperature.
- Cause: Temperature sensor cable is damaged.
- Remedy: Check temperature sensor connections.

Event Type, 0x4210-5144 (16912–5144)

NOTICE

EVENT NAME: TEMPERATURE PROTECTION 2

Reason: Thermistor has triggered a high temperature fault or warning.

- Cause: Device connected to thermistor is overheated.
- Remedy: Check the device temperature.
- Cause: Temperature sensor cable is damaged.
- Remedy: Check temperature sensor connections.

Event Type, 0x4210-5145 (16912–5145)

NOTICE

EVENT NAME: TEMPERATURE PROTECTION 3

Reason: Thermistor has triggered a high temperature fault or warning.

- Cause: Device connected to thermistor is overheated.
- Remedy: Check the device temperature.
- Cause: Temperature sensor cable is damaged.
- Remedy: Check temperature sensor connections.

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