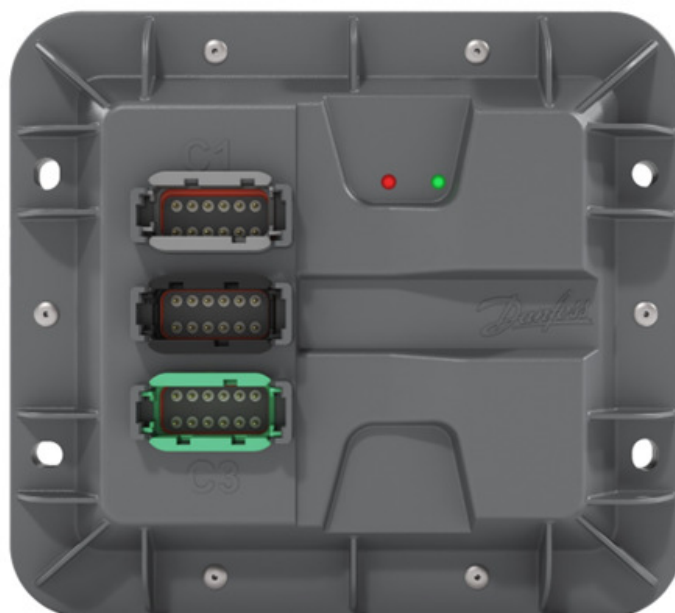


Technical Information

PLUS+1 Safety Controller

Propel Controller PC036



Revision history

Table of revisions

Date	Changed	Rev
February 2023	First edition	0101

Contents

Introduction

Literature references.....	4
API specifications (API).....	4

User Liability Safety Statements

Safety precautions.....	5
OEM responsibility.....	5
PC036 Controller.....	6
Functional safety.....	6

Product Ratings

Pin layout.....	7
Environmental Specification.....	8
Non-volatile memory read/write ratings.....	8
Event logging memory.....	9

Electrical Characteristics

Power supply and current ratings.....	10
Wake-up functions.....	10
Sensor power supplies.....	10
CAN communication.....	10
Indicator LEDs.....	10
Digital/Analog inputs (DIN/AIN).....	11
Digital/Analog/Frequency inputs (DIN/AIN/FreqIN).....	11
Digital/Analog/Current input (DIN/AIN/4-20 mA).....	12
Digital/Analog/Resistance (DIN/AIN/ResIN).....	13
Digital outputs source (DOUT - source).....	14
Digital outputs sink (DOUT - sink).....	14
PWM outputs (PWM/DOUT).....	14

Wiring and Mating Connectors

CAN Bus Wiring.....	15
Mating Connectors.....	15

Mechanical Dimensions

PC036 Controller.....	16
-----------------------	----

Product installation and start-up

Introduction

Literature references

Literature title	Document type	Literature ID
PLUS+1® Safety Controller PC036 with Propel Software Data Sheet	Data Sheet	AI435076264199

API specifications (API)

Module API specifications contain detailed information about the module BIOS. PLUS+1® BIOS functionality is pin dependent. Pins are defined in module data sheets as C (connector number) p (pin number).

API specifications include:

- Variable name
- Variable data type
- Variable direction (read/write)
- Variable function and scaling

The API specification is part of the PLUS+1® GUIDE hardware library.

[Module API specifications are the definitive source of information regarding PLUS+1® module pin characteristics.](#)

User Liability Safety Statements

Safety precautions

Always consider safety precautions before beginning a service procedure. Protect yourself and others from injury. Take the following general precautions whenever servicing a hydraulic system.

Warning

Unintended machine movement: Unintended movement of the machine or mechanism may cause injury to the technician or bystanders. To protect against unintended movement, secure the machine or disable/disconnect the mechanism while servicing.

Warning

Flammable cleaning solvents: Some cleaning solvents are flammable. To avoid possible fire, do not use cleaning solvents in an area where a source of ignition may be present.

Warning

Fluid under pressure: Escaping hydraulic fluid under pressure can have sufficient force to penetrate skin causing serious injury and/or infection. This fluid may also be hot enough to cause burns. Use caution when dealing with hydraulic fluid under pressure. Relieve pressure in the system before removing hoses, fittings, gauges or components. Never use a hand or any other body part to check for leaks in a pressurized line. Seek medical attention immediately if cut by hydraulic fluid.

Warning

Personal safety: Protect yourself from injury. User proper safety equipment, including safety glasses, at all times.

Warning

Welding on a machine: The following procedures are recommended when welding on a machine:

- Turn the engine off
- Disconnect the negative battery cable from the battery
- Do not use electrical components to ground the welder. Clamp the ground cable for the welder to the component that will be welded as close as possible to the weld.

During machine tests, make sure all persons are in safe positions. Beware that unexpected movement of the machine will not injure persons or damage property. For best practice, lift the driven wheels or tracks off the ground during start-up and test runs.

OEM responsibility

The OEM of a machine or vehicle in which Danfoss products are installed has the full responsibility for all consequences that might occur. Danfoss is not responsible for any consequences, direct or indirect, caused by failures or malfunctions.

- Danfoss is not responsible for any accidents caused by incorrectly mounted or maintained equipment.
- Danfoss assumes no responsibility for Danfoss products being incorrectly applied or the system being programmed in a manner that jeopardizes safety.
- All safety critical systems shall include an emergency stop to switch off the main supply voltage for the outputs of the electronic control system. All safety critical components shall be installed in such a way that the main supply voltage can be switched off at any time. The emergency stop must be easily accessible to the operator.

User Liability Safety Statements

PC036 Controller

PC036 Controller is a modular propel system with varying level of flexibility with regards to hardware and software packages allowing customers to maximize the efficiency of the system to the needs of their machine and application.

The spectrum of the applications goes from very simple medium power applications in turf care and simple high power applications for the rental market, to very advanced and complex speedshift or two motor transmission propel systems. We offer a modular system solution to these very much different applications, so that can guarantee a cost optimized hardware that best meets the functional needs of the application.

The PC036 controller is designed for usage with electronic controlled H1P and MP1 closed circuit pump series in all available displacements.

Functional safety

The PC0xx Propel System is designed for propel applications and fulfill the safety requirements according the EU machine directive (2006/42/EC).

- Safety Integrity Level: SIL 2 Capable
- Device Type: Type B

Type A Standards

Cover aspects applicable to all types of machines.

- IEC 61508 Functional safety of electrical/electronic/programmable electronic safety-related systems

Type B1 Standards

Cover particular safety and ergonomic aspects of machinery.

- ISO 19014: 2018 (former ISO 15998) Controller for Earth moving machinery
- EN ISO 13849-1: 2015 Safety of machinery- Safety-related parts of control systems- Part 1 & 2
- ISO 25119 Agriculture machinery (former EN 16590)

Type B2 Standards

Cover safety components and protective devices, for example: two-hand controls, interlocking devices, pressure-sensitive devices, guards);

Type C Standards

Machine safety standards dealing with detailed safety requirements for a particular machine or group of machines.

- DIN/EN 474 Earth moving machinery
- EN 1459-1: 2020 Rough-terrain trucks – Safety requirements and verification – Part 1: Variable-reach trucks
- EN 4254-1: 2021 Agricultural machinery – Safety – Part 1: General requirements
- EU 167/2013 Agricultural and Forestry vehicles (Tractor directive)
 - EU 1322/2014
 - EU 68/2015
 - EU 96/2015
 - EU 208/2015
 - EU 1788/2016

Danfoss strongly recommends that the OEM performs a system-level Failure Mode Effects Analysis (FMEA).

Product Ratings

Pin layout

Function / Pins	PC036
Power Supply Ground (KL31)	1
Power Supply Battery voltage (ignition on - KL15) wakeup pin	1
Power Supply Battery voltage (KL30)	2
Internal 5V Sensor power supply 500 mA	1
Internal 5V – 10 V Sensor power supply 500 mA	--
CAN Interface (CAN FD)	1
Inputs	16
Analog/Digital input	9
Analog/Frequency input	2
Digital /Analog/4-20mA/resistance	5
Outputs	12
PWM output 3A high side, switch to battery voltage	5
Digital output 3A low side, switch to ground	3
Digital output 4A high side, switch to battery voltage	4
Multi functional outputs 4A high or low side or PWM	--

Connector	Pin Type	Comment
C1p01	Power ground -	KL 31 (DIN 72552)
C1p02	Power supply +	KL15 (DIN 72552) switched plus (ignition on) wakeup pin
C1p03	CAN 1 High	
C1p04	CAN 1 Low	
C1p05	DIN/AIN	
C1p06	DIN/AIN	
C1p07	DIN/AIN	
C1p08	5 V Sensor Supply +	
C1p09	Sensor Ground -	
C1p10	DIN/AIN	
C1p11	DIN/AIN	
C1p12	DIN/AIN /FreqIN	
C2p01	DIN/AIN	
C2p02	DIN/AIN	
C2p03	PWM/DOUT	max 3A
C2p04	PWM/DOUT	
C2p05	DOUT - sink	switch to ground
C2p06	DOUT - sink	
C2p07	PWM/DOUT	max 3A
C2p08	DOUT - source	switch to battery +
C2p09	DOUT - source	
C2p10	DOUT - source	
C2p11	DOUT - source	
C2p12	Power supply +	KL30 (DIN 72552) battery plus

Product Ratings

Connector	Pin Type	Comment
C3p01	DIN/AIN/0-20mA	
C3p02	DIN/AIN/0-20mA	
C3p03	DIN/AIN	
C3p04	DIN/AIN/ResIN	
C3p05	DIN/AIN/ResIN	
C3p06	DIN/AIN /FreqIN	
C3p07	DIN/AIN	
C3p08	DIN/AIN/0-20mA	
C3p09	PWM/DOUT	
C3p10	PWM/DOUT	
C3p11	DOUT - sink	switch to ground
C3p12	Power supply +	KL30 (DIN 72552) battery plus

Environmental Specification

Description	
Operating Temperature Range	-40 to +105°C
Storage Temperature Range	-40 to +85 °C
Powerline Transients	ISO 7637-2, 7637-3 and ISO 16750-2
Degrees of Protection, Dust and Water	IP69k with external connectors installed IP67 without external connectors installed
Housing material	Plastic and aluminum
Vibration and Free Fall	IEC 60068 Part 2-6: Tests – Test Fc: Vibration (sinusoidal) Part 2-64: Tests – Test Fh: Vibration, Broadband Random and Guidance Part 2-29: Tests, Test Eb & Guidance: Bump Part 2-27: Tests – Test Ea & Guidance: Shock Part 2-32: Tests – Test Ed: Free Fall
Conducted EM Emissions	EN50025, ed. 3
Radiated EM Immunity	ISO 13766 (2018) – 200 MHz to 1000 MHz, 100 V/m 1000 MHz to 2700 MHz, 30V/m and lower
Conducted EM Immunity	ISO 13766 – 10 kHz to 200 MHz, 200 mA
ESD	ISO 10605; EN 61000-4-2; +/-15kV air discharge +/-8 kV contact discharge, pin discharge
Chemical Resistance	IEC 60068-2-52 and ISO 16750-2
CE rating	CE compliant

Non-volatile memory read/write ratings

EEPROM write/erase ratings

To prevent unexpected memory writes, care must be taken to ensure memory with a high number of read/write cycles: U32 or S32 data types.

Product Ratings

Write/erase cycles

Description	Minimum	Maximum	Comment
EEPROM write/erase cycles	1 million		Minimum valid over entire operating temperature range.

EEPROM in PC036 controllers is used for applications software, parameters and error loggings.

Event logging memory

Some PC036 variants have 32 Mbyte of serial flash memory for event logging. The write/erase cycle is depending on the size of memory which written/read size.

Application developers can use this memory to log machine event data and use the PLUS+1® Service Tool to extract the logged data. As there is no real time clock on PLUS+1® modules, vault memory is not time stamped.

Description	Minimum	Maximum	Comment
Flash write/erase cycles	32 Mbyte x 100,000 cycles		Minimum valid over entire operating temperature range.

Electrical Characteristics

Power supply and current ratings

PC036 Controller are designed to operate with a nominal 7 to 36 V dc power supply. The controller will survive with full functionality if the supply voltage remains below 36 Vdc. The controller are protected against reverse polarity. A fully populated PC036 controller is able to source and sink different currents in ambient temperatures of -40 °C to +105 °C. The maximum current will be limited by the power connector current rating for DEUTSCH DTM with 7.5A.

Description	Minimum	Maximum	Comment
Allowed voltage at pin		36 V	
Supply 12V system	9 V	16 V	
Supply 24V system	18 V	32 V	

	Source estimated / max	Sink estimated / max
PC036	12A / 22.5 A	3A / 7.5 A

Estimated current: estimated current for a standard application up to 105°C ambient

Max current: maximal current for an ambient temperature of 70°C

In the temperature range from 71°C to at 105°C ambient the allowed current is 80% of the max current

Wake-up functions

Pin C1p02 is used as a wake-up pin from K15 (ignition on). All other power pins are supplied with continuous battery voltage (KL30). The stand-by consumption stays below 5mA.

If K15 is switched off, the controller stay alive for minimum 15s before going to sleep. Outputs and CAN messages are active during this time.

It is possible to run the controller only with the supply to connector C1p02 (e.g. for programming with application software or parameter files).

Sensor power supplies

Symbol	Description	Values			Notes
		Min.	Typ.	Max.	
V _{out}	Nominal voltage range	4.81 V	5.0 V	5.2 V	Fixed 5V output
I _{out}	Sensor power current	0 mA	-	500 mA	

CAN communication

The PC036 has one CAN/CAN-FD port. A CAN shield pin is not provided.

- CAN Revision 2.0B
- Baud rate up to 5 Mbps, CAN-FD compatible
- No 120 Ω termination resistor installed

Indicator LEDs

The PC036 controller follows the PLUS+1® controller convention of using two LEDs that are visible to the user. Both are under application software control of the MCU. Before the application software starts running, the green LED will be on and the red LED will be off.

Electrical Characteristics

Normal operation: only green LED1 on

Sleep mode or power off: no LED on

Error code: green LED1 on + red LED2 blinking (not with watchdog error - see below)

Watchdog error green + yellow LED2 on, no red LED or both yellow LEDs on

LED 1: Green & yellow -> driven by MCU

LED 2: red -> driven by Aurix, but overruled by yellow -> driven by Watchdog

Digital/Analog inputs (DIN/AIN)

The digital/analog input has configurable resistors to pull down or up the input to either +5V or battery voltage. The D/A input can be configured to operate with middle (5V) or high (36V) input voltage ranges. The default setting is the high voltage operating range with pull down resistor.

The threshold values for digital inputs are defined in the software.

Symbol	Description	Values			Notes
		Min.	Typ.	Max.	
General:					
V _{in}	Input voltage range	0 V	-	36 V	
Middle Range:					
V _{in}	Minimum discernible voltage	0 mV	-	20 mV	
V _{in}	Maximum discernible voltage	5,13 V	5,26 V	5,38 V	
V _{in}	Precision	-	-	1.3 mV	
R _{in}	Input impedance	228 kΩ	233 kΩ	238 kΩ	No pull up or pull down
R _{in}	Input impedance (5V/GND)	13,9 kΩ	14,1 kΩ	14,3 kΩ	Pull up to +5V OR pull down to ground
R _{in}	Input impedance (2.5V)	7,2 kΩ	7,3 kΩ	7,4 kΩ	Pull up and pull down enabled. Open input = 2.5V
High Range:					
V _{in}	Minimum discernible voltage	0 mV	-	130 mV	
V _{in}	Maximum discernible voltage	34,1 V	35,3 V	36,5 V	
V _{in}	Precision	-	-	9 mV	
R _{in}	Input impedance	108 kΩ	110 kΩ	112 kΩ	No pull up or pull down
R _{in}	Input impedance (5V/Battery voltage/GND)	13,3 kΩ	13,6 kΩ	13,9 kΩ	Pull up to +5V OR pull down to ground
R _{in}	Input impedance (2.5V)	6,9 kΩ	7,1 kΩ	7,2 kΩ	Pull up and pull down enabled. Open input = 2.5V

Digital/Analog/Frequency inputs (DIN/AIN/FreqIN)

The analog/frequency input has configurable resistors to pull the input to either +5V or ground. The input can be configured to operate with middle (5V) or high (36V) input voltage ranges. The default setting is the middle voltage operating range with pull down resistor.

Electrical Characteristics

Description	Values			Notes
	Min.	Typ.	Max.	
Input voltage range	0 V	-	36 V	
Middle Range				
Minimum discernible voltage	0 mV	-	20 mV	
Maximum discernible voltage	5,13 V	5,26 V	5,38 V	
Precision	-	-	1,3 mV	
Input impedance	230 kΩ	233 kΩ	236 kΩ	No pull up or pull down
Input impedance (5V/GND)	13,9 kΩ	14,1 kΩ	14,3 kΩ	Pull up to +5V OR pull down to ground
Input impedance (2.5V)	7,2 kΩ	7,3 kΩ	7,4 kΩ	Pull up and pull down enabled. Open input = 2.5V
High Range				
Minimum discernible voltage	0 mV	-	130 mV	
Maximum discernible voltage	34,1 V	35,3 V	36,5 V	
Precision	-	-	9 mV	
Input impedance	146 kΩ	149 kΩ	152 kΩ	No pull up or pull down
Input impedance (5V/GND)	13,3 kΩ	13,6 kΩ	13,9 kΩ	Pull up to +5V OR pull down to ground
Input impedance (2.5V)	6,9 kΩ	7,1 kΩ	7,2 kΩ	Pull up and pull down enabled. Open input = 2.5V
Frequency range	0 Hz	-	10000 Hz	In steps of 1 Hz
Frequency input when used as quad count or phase shift	0 Hz	-	5000 Hz	In steps of 1 Hz
Middle Range				
Rising Voltage Threshold			3,76 V	Voltage required for frequency input to read high.
Falling Voltage Threshold	0,87 V			Voltage required for frequency input to read low.
Input impedance	230 kΩ	233 kΩ	236 kΩ	No pull up or pull down
Input impedance (5V/GND)	13,9 kΩ	14,1 kΩ	14,3 kΩ	Pull up to +5V OR pull down to ground
Input impedance (2.5V)	7,2 kΩ	7,3 kΩ	7,4 kΩ	Pull up and pull down enabled. Open input = 2.5V
High Range				
Rising Voltage Threshold			3,76 V	Voltage required for frequency input to read high.
Falling Voltage Threshold	0,87 V			Voltage required for frequency input to read low.
Input impedance	146 kΩ	149 kΩ	152 kΩ	No pull up or pull down
Input impedance (5V/GND)	13,3 kΩ	13,6 kΩ	13,9 kΩ	Pull up to +5V OR pull down to ground
Input impedance (2.5V)	6,9 kΩ	7,1 kΩ	7,2 kΩ	Pull up and pull down enabled. Open input = 2.5V

The signal levels for the frequency input are the same in both measurement ranges (Middle Range and High Range). The level will change if the pull up and pull down resistors are enabled.

Digital/Analog/Current input (DIN/AIN/4-20 mA)

The Digital/Analog/Current Input has configurable resistors to pull the input to either +5V or ground. The input can be configured to operate with middle (5V) or high (36V) input voltage ranges. The current

Electrical Characteristics

measurement uses only middle (5V) range signals. The default setting is the middle voltage operating range with pull down resistor.

Description	Values			Notes
	Min.	Typ.	Max.	
Middle Range:				
Minimum discernible voltage	0 mV	-	20 mV	
Maximum discernible voltage	5,13 V	5,26 V	5,38 V	
Precision	-	-	1,3 mV	
Input impedance	230 kΩ	233 kΩ	236 kΩ	No pull up or pull down
Input impedance (5V/GND)	13,9 kΩ	14,1 kΩ	14,3 kΩ	Pull up to +5V OR pull down to ground
Input impedance (2.5V)	7,2 kΩ	7,3 kΩ	7,4 kΩ	Pull up and pull down enabled. Open input = 2.5V
High Range:				
Minimum discernible voltage	0 mV	-	130 mV	
Maximum discernible voltage	34,1 V	35,3 V	36,5 V	
Precision	-	-	9 mV	
Input impedance	108 kΩ	110 kΩ	112 kΩ	No pull up or pull down
Input impedance (5V/GND)	13,0 kΩ	13,2 kΩ	13,4 kΩ	Pull up to +5V OR pull down to ground
Input impedance (2.5V)	6,9 kΩ	7 kΩ	7,1 kΩ	Pull up and pull down enabled. Open input = 2.5V
Current Input:				
Maximum discernible voltage			5.0 V	higher voltages will destroy input circuit
Minimum discernible current	0 mA	-	0,1 mA	
Maximum discernible current	25,3 mA	26,2 mA	27,0 mA	
Precision	-	-	6 μA	
Input impedance	198,6 Ω	200,6 Ω	202,6 Ω	pull down to ground
Maximum over-current protection time	-	-	250 ms	

Digital/Analog/Resistance (DIN/AIN/ResIN)

For the Digital/Analog characteristics, see above specification.

When configured as a resistance (rheostat/temperature) sensor input, the device will provide up to 3,76 mA current to an external load which can then be measured. The equation for calculating AD counts for a given load is: AD counts = $(30996 \times R_L / (R_L + 1322))$.

The following chart shows the relationship between AD counts and load.

High range mode and the pull up / pull down features are not available when the input is configured in Resistance mode.

Description	Values			Notes
	Min.	Typ.	Max.	
Input voltage range	0	5,0 V	7,0 V	
Measurement range	5 Ω		10 kΩ	
Accuracy		2 Ω		
Minimum discernable current	0,44 mA			10 kΩ to ground

Electrical Characteristics

Description	Values			Notes
	Min.	Typ.	Max.	
Maximum discernible current			3,76 mA	0 Ω to ground
Input impedance	1,328 k Ω	1,33 k Ω	1,331 k Ω	Pull up to +5 V

Digital outputs source (DOUT - source)

Digital Outputs Source (DOUT - source)

Description	Values			Notes
	Min.	Typ.	Max.	
Output voltage range	0 V	-	Vbatt	
Output current range	0 A	-	4 A	
Over- current trip point	6,8A	7,3 A	-	If the current exceeds the trip point, the output will be latched off.
Minimum open load current for status bit to read OK	100 mA	-	-	

Digital outputs sink (DOUT - sink)

The normal use case of a sink output is in combination with a PWM output or a digital source output.

Description	Values			Notes
	Min.	Typ.	Max.	
Output voltage range	0 V	-		Switch to GND
Output current range	0 A	-	4 A	Please consider the max current ratings. See Power supply and current ratings on page 10
Over- current trip point	-	7,3 A	-	If the current exceeds the trip point, the output will be latched off.
Feedback current measurement	50 mA	-	4 A	

PWM outputs (PWM/DOUT)

The frequency of the PWM signal is software adjustable. There is a current measurement built in to each driver circuit. Each PWM output can be used as a digital output.

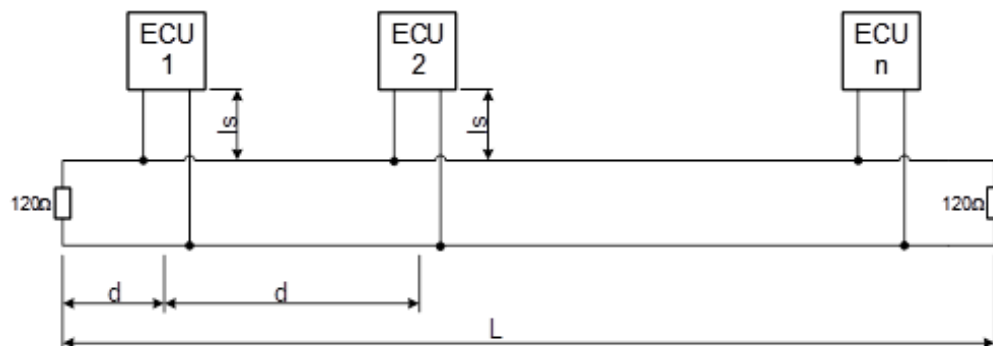
Description	Values			Notes
	Min.	Typ.	Max.	
Output voltage range	0 V	-	Vbatt	
Output current range	0 A	-	4 A	
Absolute accuracy	-	-	3 %	Percentage of full scale
Over- current trip point	-	7,3 A	-	If the current exceeds the trip point, the output will be latched off.
PWM frequency	33 Hz	-	4000 Hz	

Wiring and Mating Connectors

CAN Bus Wiring

The wiring of the vehicles CAN bus must be according SAE J1939-11 Physical layer and ISO 11898-2. The following information are an abstract of the ISO11898-2, please consider as well the official rules.

For the High-Speed (250 kbit/s) CAN bus both ends of the signal wires (CAN High and CAN Low) must be terminated with 120 Ω , because the communication flows both ways on the CAN bus.



The following points must be considered:

- Cable twisted pair
- Cable impedance (Z) 120 Ω nominal
- Length-related resistance 70 m Ω /m (copper wire 0,25mm² min)
- Maximum 30 devices (ECU) on the bus
- Maximum bus length (L) 40m
- Maximum cable stub length (ls) 0,3m
- Node distance (d) 0,1 – 40m
- Termination resistor 120 Ω on both ends
- Bus traffic less than 40% recommended

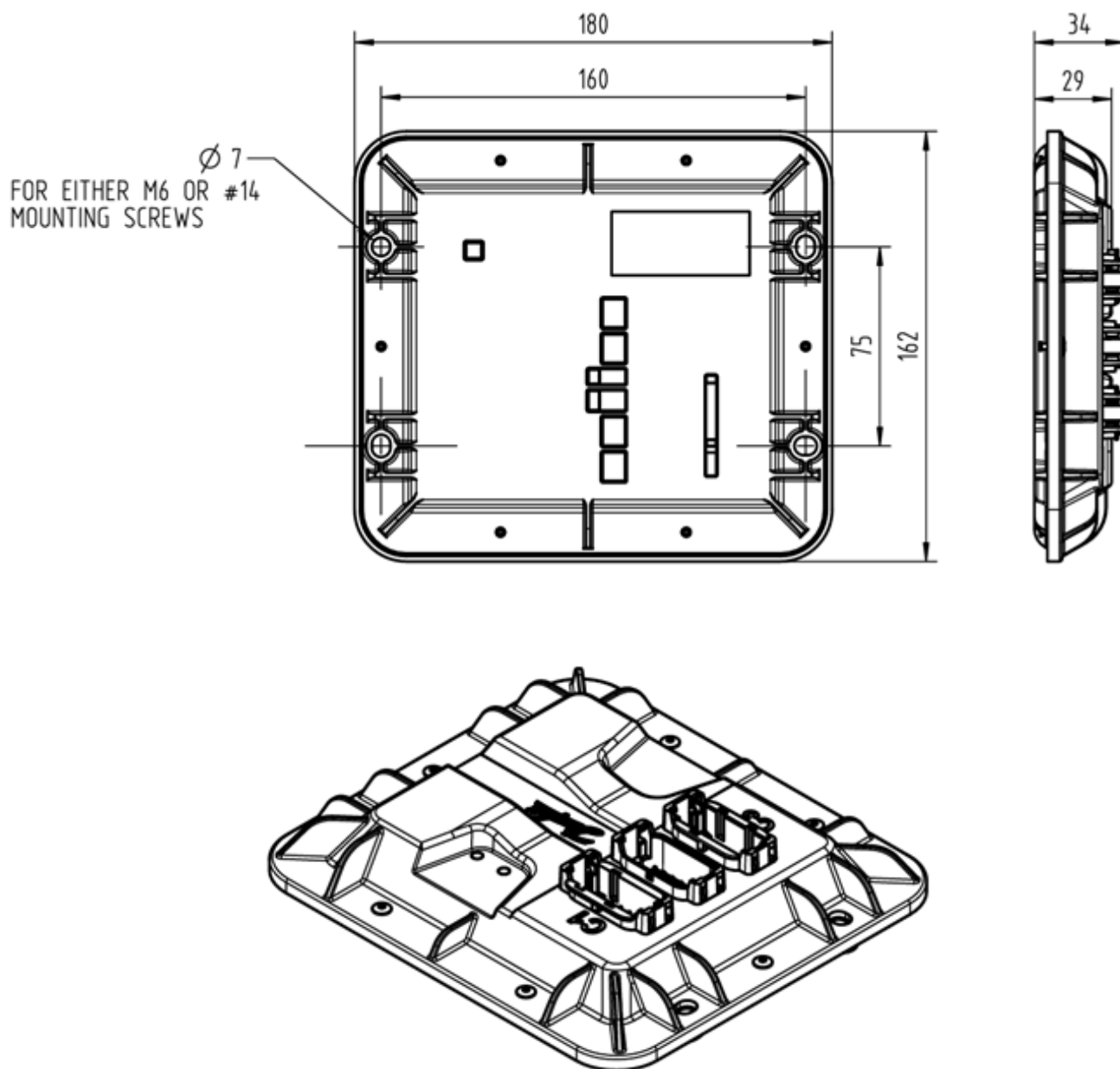
Mating Connectors

Connector	Type	Part number
C1	DEUTSCH DTM 06-12SA, grey, Key A, 12 pins	10100940
C2	DEUTSCH DTM 06-12SB, black, Key B, 12 pins	10100212
C3	DEUTSCH DTM 06-12SC, green, Key C, 12 pins	11298660
wedge	wedge lock WM-125	10100941
Blind Plug	Blind plug 0413-204-2005	10100943
contacts	Socket, 0462-201-2031, female, turned, gold, (24-20 AWG) 0,21 - 0,52 mm ²	10100942
contacs	Socket, 1062-20-0144, female, stamped, gold, (22-16 AWG) 0,32 - 1,31mm ²	10102022
Crimp tool	Crimp tool for pins (24-20 AWG) 0,21 - 0,52 mm ²	10100745
Crimp tool	Crimp tool for pins (20-16 AWG) 0,52 - 1,31 mm ²	10102028
Assembly bag PC036	Assembly Bag, DEUTSCH, PC036, (24-20 AWG) 0,21 - 0,52 mm ²	11298682
	Assembly Bag, DEUTSCH, PC036, (22-16 AWG) 0.32 - 1.31mm ²	11298683

Mechanical Dimensions

PC036 Controller

All dimensions in mm.



Product installation and start-up

If the module is side or stack mounted, provide a drip loop in the harness. If the module is mounted vertically, the connector should be on the bottom of the module.

Provide strain relief for mating connector wires.

Caution

Module damage may occur

Use caution when installing modules. Due to the size of the mating connector wire bundle, it is possible to twist of the end cap of the module if excessive pressure is applied during the installation of harness strain relief.

Fasteners

Recommended outer diameter (OD)	Recommended torque
6.0 mm (0.25 in)	2.26 N•m (20in•lbs)

Machine wiring guidelines

- Protect wires from mechanical abuse, run wires in flexible metal or plastic conduits.
- Use 85° C (185° F) wire with abrasion resistant insulation and 105° C (221° F) wire should be considered near hot surfaces.
- Use a wire size that is appropriate for the module connector.
- Separate high current wires such as solenoids, lights, alternators or fuel pumps from sensor and other noise-sensitive input wires.
- Run wires along the inside of, or close to, metal machine surfaces where possible, this simulates a shield which will minimize the effects of EMI/RFI radiation.
- Do not run wires near sharp metal corners, consider running wires through a grommet when rounding a corner.
- Do not run wires near hot machine members.
- Provide strain relief for all wires.
- Avoid running wires near moving or vibrating components.
- Avoid long, unsupported wire spans.
- Ground electronic modules to a dedicated conductor of sufficient size that is connected to the battery (-).
- Power the sensors and valve drive circuits by their dedicated wired power sources and ground returns.
- Twist sensor lines about one turn every 10 cm (4 in).
- Use wire harness anchors that will allow wires to float with respect to the machine rather than rigid anchors.

Products we offer:

- Cartridge valves
- DCV directional control valves
- Electric converters
- Electric machines
- Electric motors
- Gear motors
- Gear pumps
- Hydraulic integrated circuits (HICs)
- Hydrostatic motors
- Hydrostatic pumps
- Orbital motors
- PLUS+1® controllers
- PLUS+1® displays
- PLUS+1® joysticks and pedals
- PLUS+1® operator interfaces
- PLUS+1® sensors
- PLUS+1® software
- PLUS+1® software services, support and training
- Position controls and sensors
- PVG proportional valves
- Steering components and systems
- Telematics

Danfoss Power Solutions is a global manufacturer and supplier of high-quality hydraulic and electric components. We specialize in providing state-of-the-art technology and solutions that excel in the harsh operating conditions of the mobile off-highway market as well as the marine sector. Building on our extensive applications expertise, we work closely with you to ensure exceptional performance for a broad range of applications. We help you and other customers around the world speed up system development, reduce costs and bring vehicles and vessels to market faster.

Danfoss Power Solutions – your strongest partner in mobile hydraulics and mobile electrification.

Go to www.danfoss.com for further product information.

We offer you expert worldwide support for ensuring the best possible solutions for outstanding performance. And with an extensive network of Global Service Partners, we also provide you with comprehensive global service for all of our components.

Local address:

Hydro-Gear

www.hydro-gear.com

Daikin-Sauer-Danfoss

www.daikin-sauer-danfoss.com

**Danfoss
Power Solutions (US) Company**
2800 East 13th Street
Ames, IA 50010, USA
Phone: +1 515 239 6000

**Danfoss
Power Solutions GmbH & Co. OHG**
Krokamp 35
D-24539 Neumünster, Germany
Phone: +49 4321 871 0

**Danfoss
Power Solutions ApS**
Nordborgvej 81
DK-6430 Nordborg, Denmark
Phone: +45 7488 2222

**Danfoss
Power Solutions Trading
(Shanghai) Co., Ltd.**
Building #22, No. 1000 Jin Hai Rd
Jin Qiao, Pudong New District
Shanghai, China 201206
Phone: +86 21 2080 6201

Danfoss can accept no responsibility for possible errors in catalogues, brochures and other printed material. Danfoss reserves the right to alter its products without notice. This also applies to products already on order provided that such alterations can be made without subsequent changes being necessary in specifications already agreed. All trademarks in this material are property of the respective companies. Danfoss and the Danfoss logotype are trademarks of Danfoss A/S. All rights reserved.