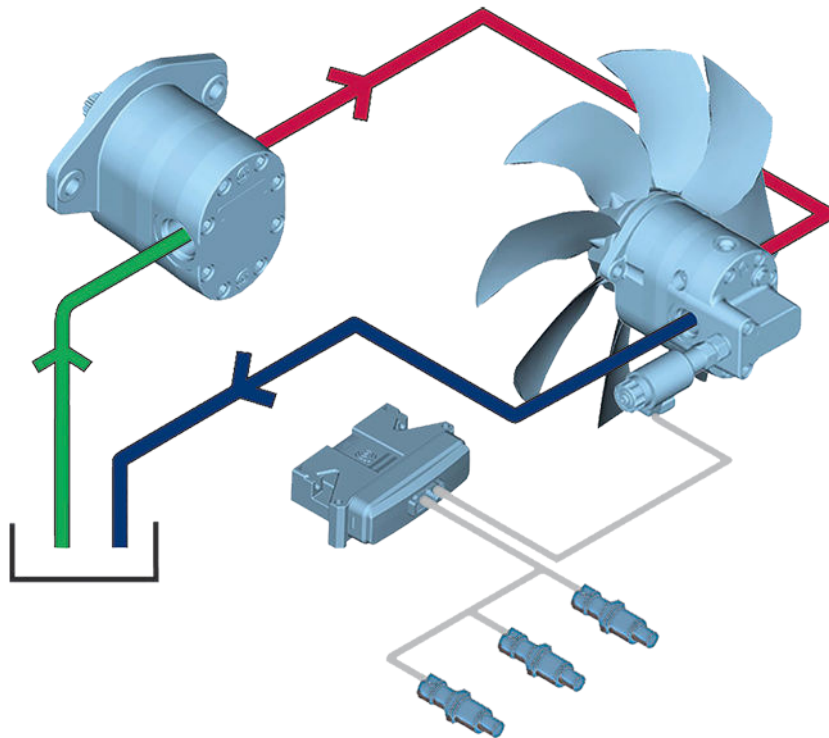


System Description

Subsystem Application

Fan Drive SSA



Revision history

Table of revisions

| Date | Changed | Rev |
|-------------|--|------------|
| May 2016 | Corrected System Overview Screen image and minor updates; Updated to Engineering Tomorrow design | 0401 |
| July 2014 | Danfoss layout | DA |
| June 2013 | Various | CA |
| April 2010 | Various | BA |
| March 2010 | First edition | AA |

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Overview

About this document

This document provides general information about the Fan Drive SSA Subsystem Application (SSA) software for use with Danfoss PLUS+1® microcontrollers and associated hydraulic and electronic products. In addition, it is a reference tool for vehicle OEM design, engineering, and service personnel.

SSA software puts 40 years of Danfoss mobile machinery propel system experience at your fingertips. It is a fully worked out application software example, enabling faster time-to-market and improved performance and functionality for both new machine designs and model variants. PLUS+1® GUIDE programmability allows developers to modify the SSA according to their individual vehicle requirements.

For control system developers programming in GUIDE, this document along with relevant software files, user manuals, and other documents is included in the Application File posted on the Danfoss web site for easy customer access and download.

This document is one of several sources of technical information for the control system. Additional sources of technical information for the control system are listed under [Referenced documentation](#) on page 7.

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 has no responsibility for any consequences, direct or indirect, caused by failures or malfunctions.

- Danfoss has no responsibility for any accidents caused by incorrectly mounted or maintained equipment.
- Danfoss does not assume any 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.

Concept and function

Danfoss electro-hydraulic fan drive systems provide precise, modulated cooling flow to the vehicle heat exchanger, much more efficiently than simple direct drive systems.

Direct drive cooling fans are sized to meet cooling requirement at relatively low engine speeds and are significantly oversized for cooling requirements at higher speeds. Electronically controlled hydraulic fan drive systems allow fan speed to be continuously matched to cooling requirements so the fan can be properly sized at low engine speeds without drawing excessive power at high speeds. Resulting vehicle fuel savings can be very significant.

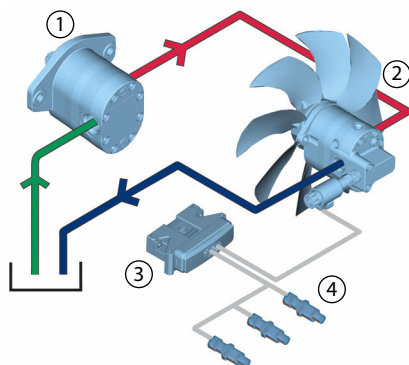
The Danfoss Fan Drive SSA monitors cooling parameter inputs, calculates cooling demand, and provides an electronic signal that controls fan speed. Possible inputs to the fan drive controller include engine coolant temperature, charge air temperature, engine or transmission oil temperature and other signals and switches that might trigger a change in operating mode. Also, many engine control systems provide a fan controlling signal or CANbus message which can serve as a cooling parameter input to the SSA.

Fan speed is controlled by regulating the amount of hydraulic oil passing through the fan motor. The greater the flow, the greater the fan speed. Cooling demand is based on one or more inputs. As inputs indicate a change in cooling demand, the system continuously adjusts flow to the motor.

The Danfoss SSA allows an operator to configure the software for a wide range of system configurations and temperature signals.

Overview

User-programmable Fan Drive Subsystem Application



kwa1406826257921

1. Gear pump
2. Fan drive gear motor
3. PLUS+1[®] microcontroller
4. Liquid temperature sensors

Benefits

The Fan Drive SSA is a fully integrated, dual path control system solution that's ready to be tailored to your vehicle requirements. The software is made up of validated component software blocks that greatly reduce vehicle testing time, provide responsive control and reduced project risk.

The graphical application code can be modified with GUIDE, using PLUS+1[®] Compliant products, such as sensors, pumps and motors.

These PLUS+1[®] Compliant products are represented by functional software blocks. These blocks can be dragged, dropped and connected to modify the Fan Drive SSA to accommodate vehicle characteristics that are different from those of the example application.

Compliance blocks that are pre-programmed for CAN communication between joysticks and PLUS+1[®] controllers are particularly easy to modify within the application.

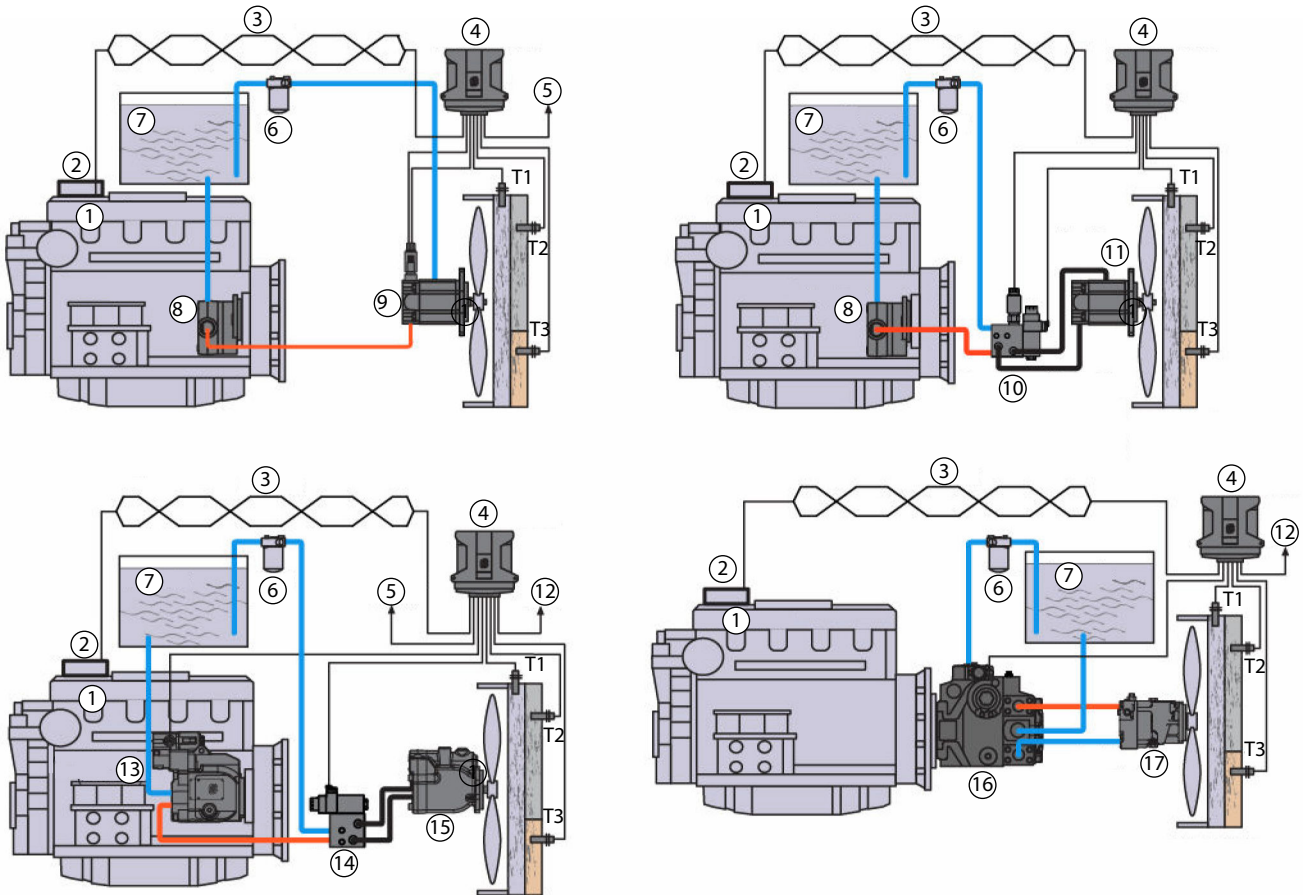
Advanced control features and flexibility of plug-in design provide state of the art system performance.

Pre-configured service screens are provided to set up the software and adjust parameters.

Overview

System configuration

Open circuit gear product with reversing (top left); Open circuit fixed displacement with reversing (top right); Open circuit variable displacement pump with reversing (bottom left); Closed circuit (bottom right)



kwa1463067366408

- | | |
|---------------------------------|--|
| 1. Diesel engine | 2. Engine control module (ECM) |
| 3. CANbus | 4. Microcontroller |
| 5. Reversing switch | 6. Filter |
| 7. Reservoir | 8. Gear pump |
| 9. Fan drive gear motor | 10. Reversing and modulating fan drive HIC |
| 11. Fan drive gear motor | 12. Signal lamp |
| 13. Variable pump (Series 45) | 14. Reversing fan drive HIC |
| 15. Piston motor (L/K) | 16. Piston pump (H1P with fan drive control) |
| 17. Fan drive motor (Series 90) | |

Referenced documentation

[Comprehensive technical literature online at powersolutions.danfoss.com](http://powersolutions.danfoss.com)

PLUS+1° software development tools

| | |
|--|----------|
| <i>PLUS+1° GUIDE Data Sheet</i> | 520L0708 |
| <i>PLUS+1° GUIDE User Manual</i> | 10100824 |
| <i>PLUS+1° Service Tool User Manual</i> | 520L0899 |
| <i>CG150 CAN/USB Gateway Interface Communicator Data Sheet</i> | 520L0945 |

Subsystem application

The application software files are listed under [Application file](#) on page 12.

| | |
|--|----------|
| <i>Fan Drive System Description</i> | 11076673 |
| <i>PLUS+1° Fan Drive Subsystem Application Software Data Sheet</i> | 11076672 |
| <i>MC024-014 Fan Drive SSA User Manual</i> | 70032972 |
| <i>MC012-029 Fan Drive SSA User Manual</i> | 70101988 |
| <i>MC024-014 Fan Drive SSA I/O Mapping User Manual</i> | 70037066 |
| <i>MC012-029 Fan Drive SSA I/O Mapping User Manual</i> | 70101997 |
| <i>Fan Drive Application Block User Manual</i> | 70025726 |
| <i>Service Screens for Fan Drive Application Block User Manual</i> | 70025725 |
| <i>Reversal Plug-in User Manual</i> | 70025727 |

Electronic product

Sensors

| | |
|--|----------|
| Standard/Extended Range Liquid and Air Temperature Sensors Data Sheet | 11076525 |
|--|----------|

Control system

System development tools



PLUS+1° GUIDE (Graphical User Integrated Development Environment) is a desktop software development tool used to create and customize application software to specific vehicle requirements. GUIDE's graphical editor allows easy development or modification of example applications by system engineers without formal software development training.

Components and application blocks can be dragged from the component selector and dropped onto the programming workspace for time-saving system design in the PLUS+1° GUIDE environment, generating downloadable applications for all programmable PLUS+1° controllers and displays.

PLUS+1° Service Tool uses the CG150 Interface Communicator for programming PLUS+1° controllers via CAN bus from a computer. Additionally, the PLUS+1° Service Tool features data logging capabilities with oscilloscope and bar graph displays used for diagnostics and tuning. Graphical design features allow development of specialized service screens to support applications created in PLUS+1° GUIDE.

The CG150 CAN/USB Gateway Interface Communicator serves as the interface between PLUS+1° modules on the vehicle CAN network and a laptop USB port.

Application hardware

The SSA software may only be loaded onto keyed PLUS+1° application hardware. If the application hardware key matches the Danfoss application software key the service tool permits the download to the target application hardware.

[Danfoss application key number is: 10106603](#)

[See product data sheet for controllers assembly part numbers.](#)

Control system

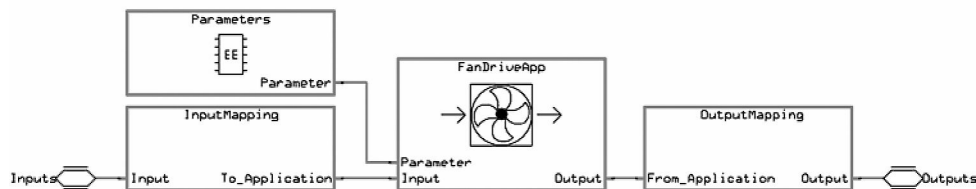
Software details

GUIDE-programmable

PLUS+1° GUIDE programmable application software blocks. Graphical application code contained in the PLUS+1° GUIDE programmable pages of the SSA can be modified by the user to tailor the application to the specific needs of the vehicle or PLUS+1° controllers that are different from the example provided by Danfoss.

- The InMap Block connects hardware input signals to the appropriate software application signals; programmability allows adaptation of the software to PLUS+1° microcontrollers with different pin-out configurations.
- The Input Cond Block converts incoming raw signals from InMap into meaningful command values; programmability allows use of sensors and input devices other than the ones used in the example software.
- The Fault Block receives signal reports and manages corresponding actions, such as function disabling, fault recording and LED blink code errors; programmability allows tailoring of fault modes to specific vehicle design and shut down behavior characteristics.
- The following fault modes are pre-configured to avoid engine or Fan Drive system damage:
 - If one or more temperature signals are lost, system goes to full fan on condition until the controller is powered off.
 - If fan control valve fails, it is not possible to activate the reversing sequence.
 - If the reversing valve fails during normal operation the system maintains temperature control and prevents activation of reversing.
 - If the reversing valve fails during reversing sequence before being activated the reversing sequence is interrupted.
 - If the reversing valve fails during reversing sequence after being activated, the reversing valve remains in it's last state.
- Output mapping converts percentage command signals into the corresponding valve output currents; programmability allows connection to a range of electrohydraulic actuators, and selection of controller output pins.
- Parameters contain configuration values for the system.

I/O mapping



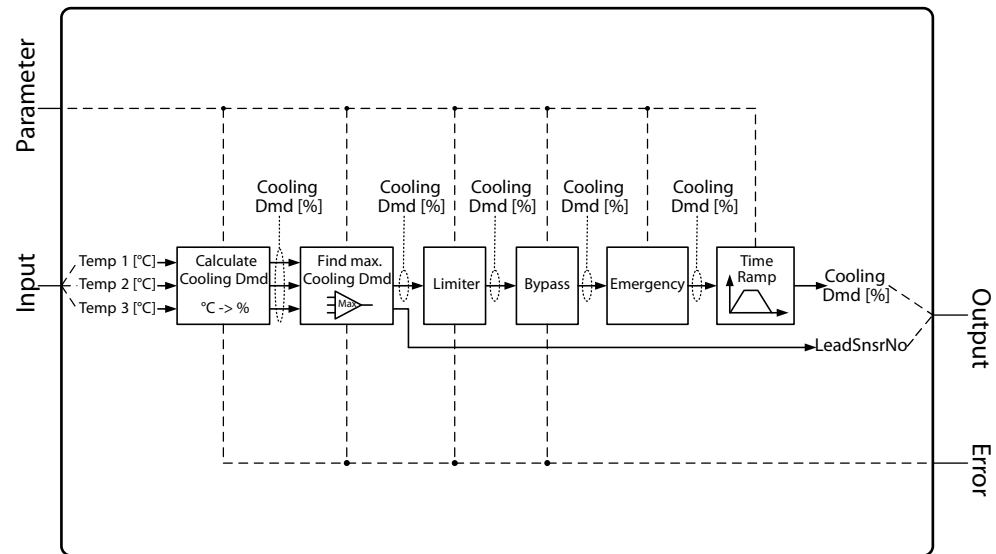
P108243

Application block

The software application block converts temperature inputs to output cooling demand. Three temperature input signals are supported, and modulated ramps adjust the controller output to maintain a balance between heat generation and cooling. User-adjustable time ramps avoid mechanical stress caused by suddenly accelerating or decelerating the fan.

Control system

Application block diagram



P108210E

Temperature inputs, normal mode, limiter mode, and bypass mode:

- Temperature inputs for up to 3 cooling mediums may be configured. Temperature signals may be provided by either multiple temperature sensors wired to the PLUS+1 microcontroller, and/or the following CANbus messages from the engine control module data bus in any combination:
 - Standard J1939 coolant temperature message
 - Standard J1939 intercooler temperature message
 - Customized message
 - Normal mode is typically used. The cooling demand is determined by the three temperature inputs, and the input signal type is standardized to degree Celsius (°C). Depending on the temperature control range a cooling demand in percentage (%) for each input is calculated. The maximum cooling demand determines fan speed. Engine start-up procedure sets the cooling demand to minimum for ten seconds after power-up of the controller.
 - Limiter mode defines maximum and minimum cooling demand. Setting an upper limit of the cooling demand reduces maximum fan speed. Setting a lower limit of the cooling demand increases the minimum fan speed.
 - Bypass mode permits manual cooling demand setting.
- Emergency mode and peak output command:
- Emergency mode overrides normal, limiter, and bypass mode. System response is user-configurable. Emergency mode commands either 0 or 100% cooling demand.
 - Peak output command provides an optional intermittent output command, triggered when the system transitions from a low pressure, low speed setting to a higher pressure, higher speed. This feature initiates smooth and reliable starting of small displacement gear motors at low pressure.

Plug-ins

The Application Block accepts optional plug-in modules. Plug-ins provide design flexibility by allowing enhanced features or performance. They may be used or deleted to conserve code space. Basic dual path control functionality is preserved by replacing plug-ins with jumpers.

Reversing

- Reverse option initiates an operating sequence which temporarily changes the rotation of the fan. The reversal of the fan can be triggered manually by a switch or automatically by a timer. If this is done a complete reversal sequence will be executed.

Control system

- The reverse option is especially helpful if the machine is working in a dusty agricultural environment or construction site where the cooling package can become choked and have reduced cooling capability. Changing the rotation direction of the fan will blow out air through the package and clean it.
- The Fan Drive SSA is provided with the reversing plug-in installed.

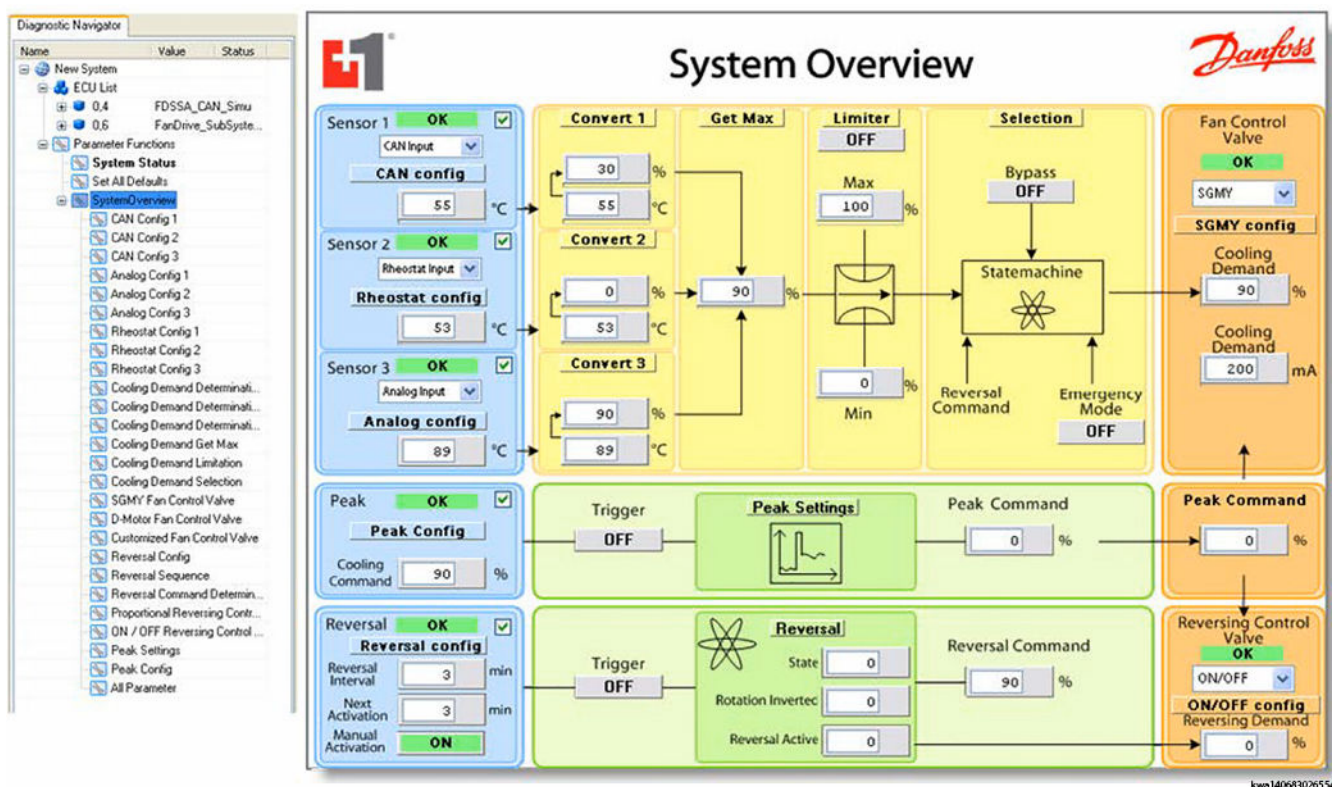
Service Tool configurability

The **System Overview** provides a summary of the fan drive diagnostic screens. Inputs are displayed on the left side, fan control logic is seen in the middle, and outputs are on the right side.

Headlines (such as, **Peak Config**) are linked to subpages, which allow the operator to get more information on the specific part of the system and to adjust it through parameters. These subpages have background colors that are consistent with the **System Overview** screen, so it is easy to see which pages belong together and which pages are dealing with each part of the system.

Detected errors are displayed on the overview page. More detailed error descriptions can be found on corresponding subpages.

System Overview screen and Diagnostic Navigator



Control system

Service screens

Service screens are provided to enable and configure the following features:

- Selection of temperature signals from sensors (1-3) and configuring sensor type or CAN temperature message
- Scaling of the input signals to temperature values
- Operating Mode enabling and configuration
- Optional Reverse activation, commands and sequencing
- Peak intermittent activation settings
- Output calibration values and ramps

Downloading SSA software

PLUS+1® GUIDE license holders may visit the Danfoss web site, download the application file, and install the enclosed software and documentation on their hard drive.

- The application file contents are downloaded to your computer by clicking on the SSA exe.zip link, clicking through the user acceptance agreement and installing the contents in the folder you specify on your hard drive.

Application file

Application file for SSA software products contains all SSA graphical source code files, all required service screens software files, and all software product documentation and user manuals associated with the SSA. The software product documentation and user manuals (PDF) files are listed under [Referenced documentation](#) on page 7: [Subsystem Application](#).

The Application file for the Fan Drive SSA includes the following software files:

| | | |
|---|-------|---------------|
| MC024-014 Software Installer Executable | .EXE | 11074843 Vxxx |
| MC012-029 Software Installer Executable | .EXE | 11104675 Vxxx |
| MC024-014 Subsystem Application Software | .P1P | 11074843_Sxxx |
| MC012-029 Subsystem Application Software | .P1P | 11104675_Sxxx |
| Application Block Software | .SCS | 11066389_Sxxx |
| Plug-in Jumper | .SCS | 11066390_Sxxx |
| Reversal Plug-in Software | .SCS | 11066402_Sxxx |
| Release Notes | .HTML | — — |

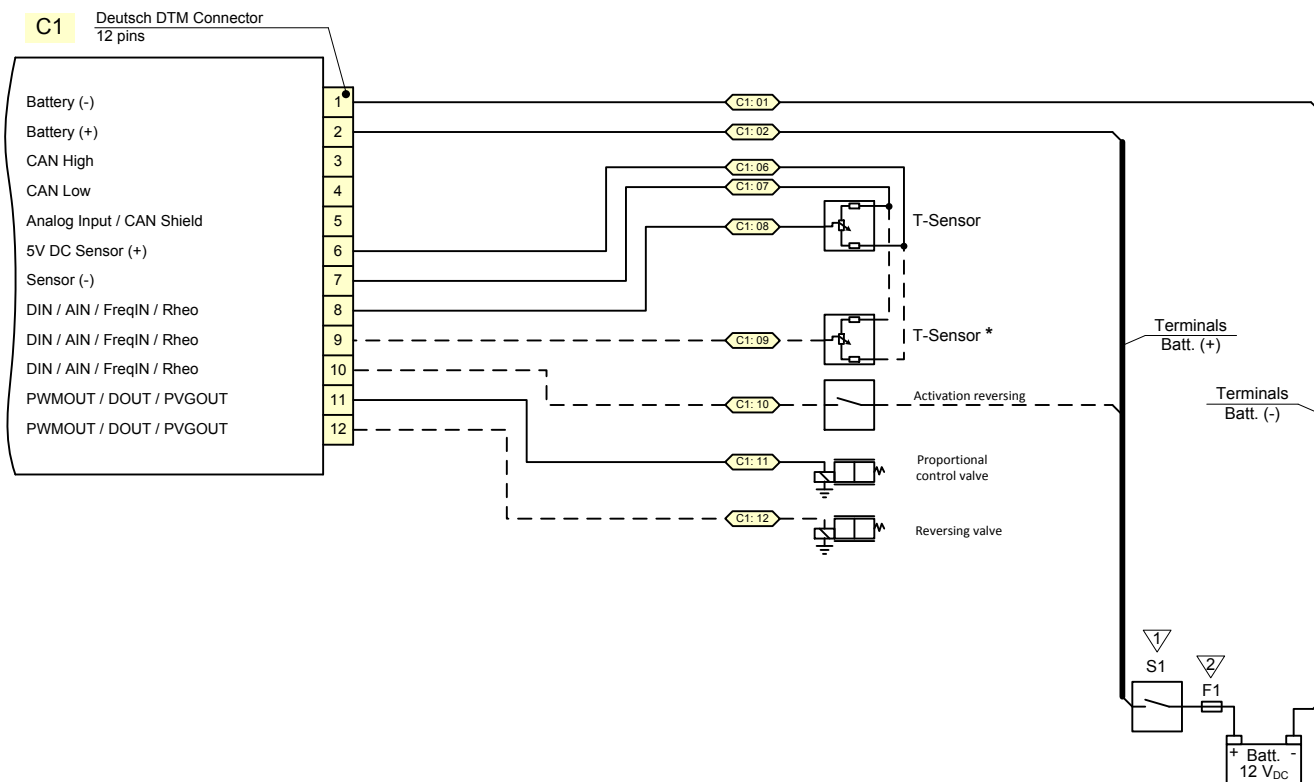
Control system

Sample application wiring diagrams

12 pin sample application wiring diagram

The Fan Drive SSA sample application wiring diagram has been designed to operate on the 12 pin PLUS +1* MC012-029 microcontroller.

Sample application wiring diagram



P200111

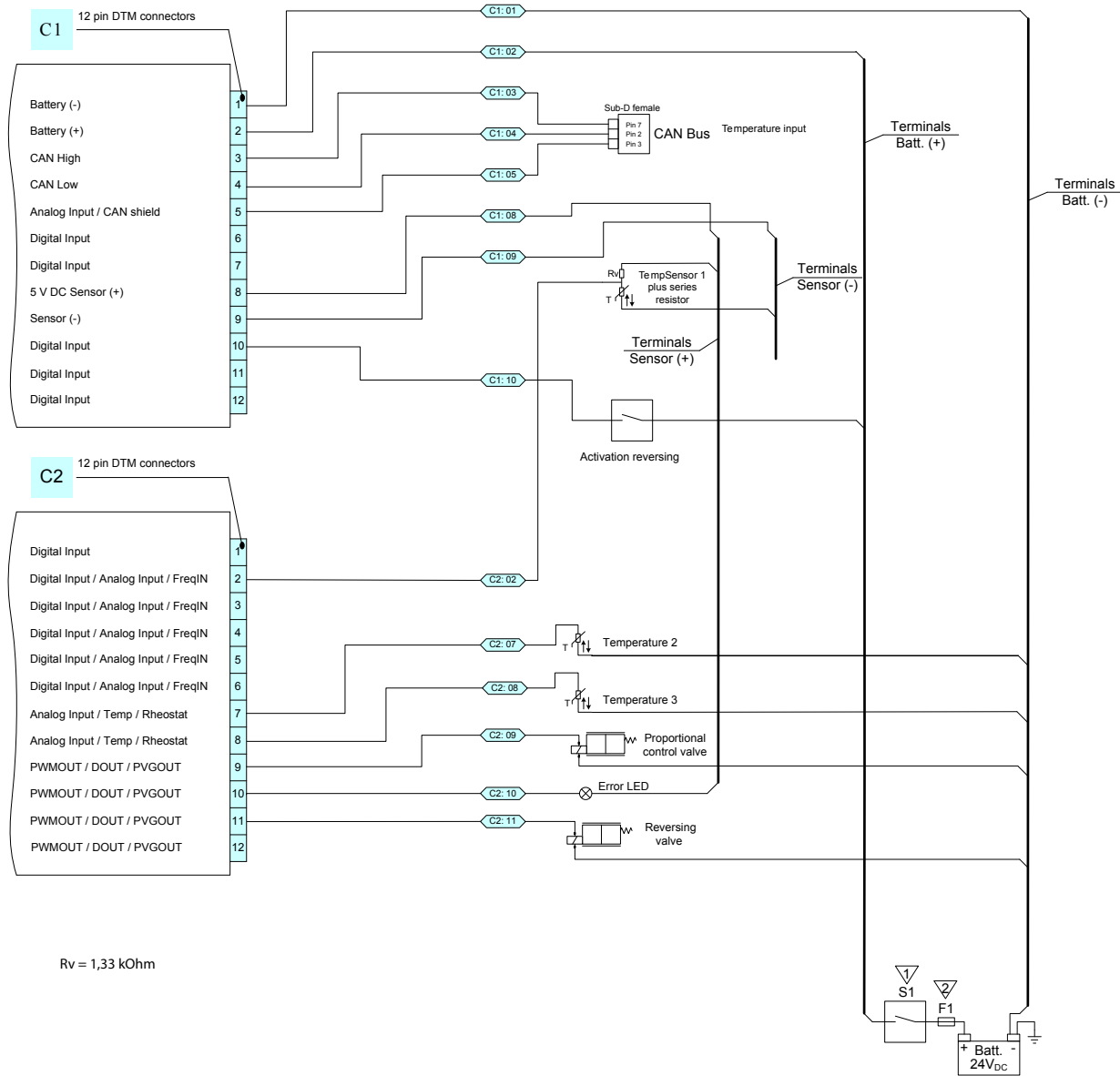
12 pin application function

| Pin | Controller function | Application function |
|--------|-----------------------|--|
| C1-P1 | Power ground - | Power (-) |
| C1-P2 | Power supply + | Power (+) |
| C1-P3 | CAN + | J1939 CAN (+) / (opt. Temp 1/2/3) |
| C1-P4 | CAN - | J1939 CAN (-) |
| C1-P5 | AIN/CAN shield | J1939 CAN shield |
| C1-P6 | 5 Vdc sensor power + | |
| C1-P7 | Sensor power ground - | |
| C1-P8 | DIN/AIN/FreqIN/Rheo | Sensor supply |
| C1-P9 | DIN/AIN/FreqIN/Rheo | Sensor supply |
| C1-P10 | DIN/AIN/FreqIN/Rheo | Reverse activation (mechanical switch) |
| C1-P11 | PWMOUT/DOUT/PVGOUT | Proportional control valve |
| C1-P12 | PWMOUT/DOUT/PVGOUT | Reversing valve |

Control system

24 pin sample application wiring diagram

Sample application wiring diagram



Rv = 1,33 kOhm

P108235

24 pin application function: Connector 1

| Pin | Controller function | Application function |
|-------|---------------------|-----------------------------------|
| C1-P1 | Power ground - | Power (-) |
| C1-P2 | Power supply + | Power (+) |
| C1-P3 | CAN + | J1939 CAN (+) / (opt. Temp 1/2/3) |
| C1-P4 | CAN - | J1939 CAN (-) |
| C1-P5 | AIN/CAN shield | J1939 CAN shield |
| C1-P6 | DIN | |
| C1-P7 | DIN | |

Control system

24 pin application function: Connector 1 (continued)

| Pin | Controller function | Application function |
|--------|-----------------------|--|
| C1-P8 | 5 Vdc sensor power + | Sensor supply |
| C1-P9 | Sensor power ground - | Sensor supply |
| C1-P10 | DIN | Reverse activation (mechanical switch) |
| C1-P11 | DIN | |
| C1-P12 | DIN | |

24 pin application function: Connector 2

| Pin | Controller function | Application function |
|--------|---------------------|--------------------------|
| C2-P1 | DIN | |
| C2-P2 | DIN/AIN/FreqIN | Temperature sensor 1 |
| C2-P3 | DIN/AIN/FreqIN | |
| C2-P4 | DIN/AIN/FreqIN | |
| C2-P5 | DIN/AIN/FreqIN | |
| C2-P6 | DIN/AIN/FreqIN | |
| C2-P7 | AIN/Temp/Rheo | Temperature sensor 2 |
| C2-P8 | AIN/Temp/Rheo | Temperature sensor 3 |
| C2-P9 | PWMOUT/DOOUT/PVGOUT | Proportional fan control |
| C2-P10 | PWMOUT/DOOUT/PVGOUT | Error LED |
| C2-P11 | PWMOUT/DOOUT/PVGOUT | Fan reversing control |
| C2-P12 | PWMOUT/DOOUT/PVGOUT | |

Related products

Electronic product details

PLUS+1° microcontrollers



- High speed DSP technology to process even the most complex applications
- CAN-based communications for state-of-the art control performance
- 256K internal flash memory is recommended

PLUS+1° expansion modules



- Expand control system capabilities with CAN-based Input/Output modules
- 12 and 24 pin housings with five possible configurations
- Stackable design for optimum mounting flexibility

DP200 and DP250 displays



- Cost effective alternative to existing analogue gauges
- DP200 high-resolution monochrome displays fit every budget without compromising performance
- DP250 high resolution color TFT (240x320 pixels, 15-bit color) displays are viewable in a wide range of lighting conditions
- Options featuring front USB 2.0 port for easy connection to PC-based service and diagnostic tools, extended I/O for improved input design flexibility, real-time clock, and display heater
- Customize the look and feel of engine monitoring and performance messages with Engine Information Center (EIC) application software
 - Read and display engine operation and performance messages which are transmitted by the engine control module over a J1939 CANbus
 - Supports fifty engine and machine performance variables on up to four screens with up to four variables per screen
 - Soft keys at the front of the display provide the operator with easy navigation through diagnostic and engine information

Related products

Liquid temperature sensor



kwa1381520056634

Brass body construction with integrated connector.

Products we offer:

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- Closed Circuit Axial Piston Pumps and Motors
- Displays
- Electrohydraulic Power Steering
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- Joysticks and Control Handles
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- PLUS+1® GUIDE
- Proportional Valves
- Sensors
- Steering
- Transit Mixer Drives

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We help OEMs around the world speed up system development, reduce costs and bring vehicles to market faster.

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Wherever off-highway vehicles are at work, so is Danfoss. We offer expert worldwide support for our customers, ensuring the best possible solutions for outstanding performance. And with an extensive network of Global Service Partners, we also provide comprehensive global service for all of our components.

Please contact the Danfoss Power Solution representative nearest you.

Comatrol

www.comatrol.com

Schwarzmueller-Inverter

www.schwarzmueller-inverter.com

Turolla

www.turollaocg.com

Hydro-Gear

www.hydro-gear.com

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