MAKING MODERN LIVING POSSIBLE

Technical Information

PLUS+1® Mobile Machine Displays
DP7XX Series

Revision History

Table of Revisons

Date	Page	Changed	Rev
19 Mar 2014	10	Update note to warning	DB
05 Dec 2013	5, 8, 14, 19	LCD option table added, changed Panel Mounting Kit part number	DA
14 Oct 2013		Various	CA
12 Jul 2013	11, 14	Corrected typo and added section	BA
13 May 2013			AA

Contents

Reference Documents

Literature Types

Technical Information (TI)
A TI is comprehensive information for engineering and service personnel to reference.

Data Sheet (DS)
A DS is summarized information and parameters that are unique to a specific model.

API Specifications (API)
An API is specifications for programming variable settings.

API specifications are the definitive source of information regarding pin characteristics.

PLUS+1® GUIDE Software User Manual
This user operation manual (OP) details information regarding the PLUS+1 GUIDE software tool set that is used to build PLUS+1 applications.

DP7XX Series PLUS+1 Mobile Machine Displays Reference Documents

Literature title	Literature type	Literature number
DP7XX Series PLUS+1 Mobile Machine Displays	Technical Information	L1315553
DP700 Series PLUS+1 Mobile Machine Displays	Data Sheet	L1205618
DP710 Series PLUS+1 Mobile Machine Displays	Data Sheet	L1205246
DP720 Series PLUS+1 Mobile Machine Displays	Data Sheet	L1205154
PLUS+1 GUIDE Software User Manual	Operation Manual	10100824

Technical Literature is on line at: www.Danfoss.com

Product Overview

DP7XX Series PLUS+1 Mobile Machine Displays
The DP700 is designed to perform in the most extreme mobile machine environments.

The DP700 offers three different display options to meet your application needs for both in-cab and open usage. An optional Projective Capacitive touch screen that works through mud, water and with gloves is available.

The latest technology with backlight provides outstanding brightness and contrast performance resulting in an easy-to-read screen.

Develop your own software and layout with PLUS+1 GUIDE and the screen editor. A graphic library is available for fast time-to-market.

LCD Options

LCD Option	Type	Contrast	Brightness (cd/m^2)	Viewing Angle*	For application use
Value	Transmissive	600:1	500	60°, 60°, 70°, 70°	In-cab
Standard	Transmissive	1000:1	400	80°, 80°, 80°, 80°	In and out of cab
High-performance	Transmissive-Enhanced View TFT	800:1	550	80°, 80°, 80°, 80°	In and out of cab

* Viewing Angle: Up, Down, Right, Left

GPL-License (General Public License)
The DP7XX family of products contains embedded Linux operating system software that is copyrighted software licensed under the GPLv2 or LGPLv2.1. As an installer of this product you will have your own obligations under the licensing agreements, which may include among other things the obligation to include a copy of these licenses or to include an offer of a physical copy of the source code for such software with your distributions of the equipment. You should carefully review the licenses to determine what your obligations and options may be for your intended use.

For further details, please reference:
http://powersolutions.danfoss.com/products/mobileElectronics/plus1guide/plus1GuideDownloads/plu1guideservicetoolsoftwarelicense/index.htm

Programming can be done either using the PLUS+1 GUIDE (Graphical User Integrated Development Environment) or Linux interface.

PLUS+1 GUIDE is a complete toolbox that generates downloadable applications for all programmable PLUS+1 Compliant products.

A screen editor allows easy development of applications by programmers without formal software development training. The expertise from a software engineer is not needed to find the way around in GUIDE.

The DP700 series hardware contains the following features for the Linux interface:
- The 1st stage of U-Boot boot loader is installed on the system.
- There is a recovery system for reprogramming the DP700 series Operating System utilizing the PLUS+1 Service Tool.
- Linux Kernel v2.6 with drivers for all standard peripherals.
- To give the developer the possibility to connect to Linux Shell it is enabled by default.

User Liability and Safety Statements

OEM Responsibility

The OEM of a machine or vehicle in which a Danfoss product is 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.

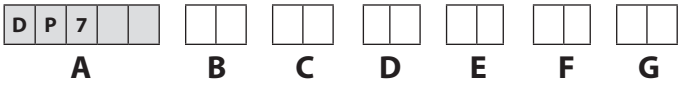
- Danfoss has no responsibility for any accidents caused by incorrectly mounted or maintained equipment.
- Danfoss does not assume any responsibility for Danfoss products being incorrectly applied or the system being programmed in a manner that jeopardizes safety.
- All safety critical systems shall 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.

Ordering Information

Model Features

Use the following table to identify model features.

This is not a variant configurator.



Product Configuration Model Code

A	B	C	D	E	F	G	Part number
DP700	01	01	01	02	04	01	11126309
DP700	02	01	01	02	04	01	11126310
DP700	03	01	01	02	04	01	11126311
DP710	01	01	02	02	04	01	11126322
DP710	02	01	02	02	04	01	11126323
DP710	03	01	02	02	04	01	11126324
DP720	01	02	02	02	04	01	11126325
DP720	02	02	02	02	04	01	11126326
DP720	03	02	02	02	04	01	11126327

A *Model Name*

DP700	PLUS+1 Mobile Machine Displays
DP710	
DP720	

B *LCD Options*

01	Value—Transmissive
02	Standard—Transmissive
03	High performance—Transmissive-Enhanced View TFT

C *Touch Screen Options*

01	None
02	Projective Capacitive touch

D *Input/ Output Options*

01	User configurable 1 CAN, 2 AIN/DIN, 2 DIN/AIN/FreqIn/Rheo/4-20 mA IN, DOUT 2 CAN, 2 DIN/AIN/FreqIn/Rheo/4-20 mA IN, DOUT
02	User configurable 1 CAN, 2 AIN/DIN, 2 DIN/AIN/FreqIn/Rheo/4-20 mA IN, 2 Video IN, DOUT 2 CAN, 2 DIN/AIN/FreqIn/Rheo/4-20 mA IN, 2 Video IN, DOUT

E *Flash Memory/ Application Key*

02	512 MB/without application key

F *USB Port Type*

04	USB device rear/USB host rear or front

G *Application Log (Vault Memory)*

01	16 MB

Related Products

Danfoss Assembled Mating Connector Kits

DP7XX mating connector kit and contents	Part numbers
Connectors	
M12 5-pin male	11130712
M12 8-pin male	11130713
Terminal	
Deutsch	10100743
Crimp tool	
16 to 20 AWG	10100744
20 to 24 AWG	10100745
Locking plug	
12-pin Deutsch WM 12S	10100741
12-pin connector kit (16 to 20 AWG)	
Deutsch DTM06-12SA 12-pin connector	10102025
12-pin connector kit (20 to 24 AWG)	
Deutsch DTM06-12SA 12-pin connector	10100944
Connection-kit DP7XX with camera cable*	**11130520**

* Only valid for DP710 and DP720.

Accessories

Description	Part number
Panel mounting kit	11144800
USB cable (device only)	11130518
USB cable (device and host)	11130519
Compact color camera, 12 V	10100831
PLUS+1 GUIDE Software Application (includes a single user licence, Service and Diagnostic tool and a Screen Editor)	10101000

Inputs/Outputs

Inputs

DP7XX Series displays support the following pin types:
- Digital or Analog (DIN/AIN)
- Multifunction (DIN/AIN/FreqIN, Rheo, 4–20 mA)
- Fixed Range Analog or CAN shield (AIN/CAN shield)

DP7XX Series displays have input pins that support multiple functions. Pins that support multiple input types are user-configurable using PLUS+1 GUIDE software.

Digital/Analog

Low Range Multifunction Input

Description	Unit	Minimum	Maximum	Comment
Range	mV	0	>400	—
Resolution	mV	0.1		1 mV in software
Worst case error	mV	±(0.15 + U*5/2%)		—
Input impedance	kΩ	230 ± 3		To 0 V
Input impedance with pull-down	kΩ	14.1 ± 0.3		To 0 V
Input impedance with pull-up	kΩ	14.1 ± 0.3		To 5 V
Input impedance with pull-up/down	kΩ	7.27 ± 0.2		To 2.5 V

Normal Range Multifunction Input

Description	Unit	Minimum	Maximum	Comment
Range	V	0	5.75	—
Resolution	mV	1.4		—
Worst case error	mV	±(20 + U*2%)		—
Input impedance	kΩ	233 ± 3		To 0 V
Input impedance with pull-down	kΩ	14.1 ± 0.3		To 0 V
Input impedance with pull-up	kΩ	14.1 ± 0.3		To 5 V
Input impedance with pull-up/down	kΩ	7.27 ± 0.2		To 2.5 V

High Range Multifunction Input

Description	Unit	Minimum	Maximum	Comment
Range	mV	0	36	—
Resolution	mV	8.8		—
Worst case error	mV	±(300 + U*3.8%)		—
Input impedance	kΩ	109.3 ± 2		To 0 V
Input impedance with pull-down	kΩ	13.2 ± 0.3		To 0 V
Input impedance with pull-up	kΩ	13.2 ± 0.3		To 5 V
Input impedance with pull-up/down	kΩ	7.02 ± 0.2		To 2.5 V

Multifunction

Frequency Input Low Range (PPU)

Description	Unit	Minimum	Maximum	Comment
Range	Hz	0	10000	In steps of 1 Hz
Sensitivity	mVpp	1000	—	Sinus peak-to-peak
Low threshold voltage	mV	75	200	—
High threshold voltage	mV	150	350	—
Input impedance	kΩ	233 ± 3		To 0 V
Input impedance with pull-down	kΩ	14.1 ± 0.3		To 0 V
Input impedance with pull-up	kΩ	14.1 ± 0.3		To 5 V
Input impedance with pull-up/down	kΩ	7.27 ± 0.2		To 2.5 V

Frequency Input Normal Range (PPU)

Description	Unit	Minimum	Maximum	Comment
Range	Hz	0	10000	In steps of 1 Hz
Range (phase and quad)	Hz	0	5000	When measuring phase or quadrature counts
Low threshold voltage	V	1.1	2.6	—
High threshold voltage	V	2.2	4.4	—
Input impedance	kΩ	233 ± 3		To 0 V
Input impedance with pull-down	kΩ	14.1 ± 0.3		To 0 V
Input impedance with pull-up	kΩ	14.1 ± 0.3		To 5 V
Input impedance with pull-up/down	kΩ	7.27 ± 0.2		To 2.5 V

Resistance Input

Description	Unit	Minimum	Maximum	Comment
Range	Ω	0	10000	In steps of 1 Ω
Resolution		1		@ 0 Ω
		2		@ 1 kΩ
		42		@ 10 kΩ
Source current	m	0	4	—

4–20 mA Input

Description	Unit	Minimum	Maximum	Comment
Range	mA	0	50	—
Resolution	µA	22		—
Worst case error	mA	±(0.2 + I*3%)		—
Input impedance	Ω	100 ± 2		To 0 V
Shut-off current	mA	54		—

⚠ Warning

Using these inputs can affect the accuracy of any Safety Critical closed loop control. These displays do not have a Real Time Operating System (RTOS). Do not use these displays as the master control for any type of safety critical control, or closed loop control system. Frequency inputs are managed by the operating system. Accuracy can be affected by processor load. These displays should only be used for non-safety critical related functions.

Encoder

The encoder input is only suitable for user interface functions, such as, navigating in menus and adjusting values because there is no guarantee that all pulses are detected and the detected direction can be false. The rate of pulses should be kept at a few tens per second to minimize the loss of detected position changes.

The encoder function samples the A and B signals from the encoder and increments or decrements the counter according to the phase sequence. The counter is incremented/decremented on every low to high and high to low edge of the A signal. Some encoders with detents give a complete pulse between detents and the counter will be incremented/decremented by two for every detent. The counter is incremented when the A signal is the leading phase and decremented in the opposite case.

Outputs

Digital Output

Only to be used for buzzer output.

USB

USB Input/Output

Description	Unit	Minimum	Maximum	Typical	Comment
2.0 full speed	Mbit/s	—	—	12	—
Vbus input voltage	V	—	—	> 4.4	—
Vbus input resistance	kΩ	—	—	70	Vbus < 5.25 V
Short circuit protection (No damage)	V	0	36	—	—
Vbus output voltage	V	4.75	5.25	—	—
Vbus output current	A	—	—	0.5	—
Vbus short current	A	—	1.1	—	—

The DP7XX series displays all have USB ports that support memory sticks and computer connection. The DP7XX functions as a device when connected to a computer for diagnosis purposes or software download. The DP7XX functions as a host when a standard USB memory stick is connected so log-data can be transferred. There is also an option for a front type-A USB connector. The front connector is USB host, the rear connector is USB host and device. You can only use one host connection at a time (either front or rear), but you can use front host and rear device at the same time.

Other than supporting memory sticks and computer connection, the DP7XX series display USB port does not support any other standard computer peripherals.

Video

Video Output

Description	Unit	Minimum	Maximum	Typical	Comment
Short circuit protection	V	0	36	—	—
12 V output voltage (9 V < Ubat < 70 V)	V	11.5	12.5	12	—
12 V output current	A	—	—	0.5	Vbus < 5.25 V
24 V output voltage (9 V < Ubat < 70 V)	V	23	24	24	—
24 V output current	A	—	0.5	—	—
Video inputs	—	—	—	—	Both NTSC and PAL support

Controller Area Network (CAN) Specifications

CAN Shield/Analog Inputs

The CAN shield pin on the unit can be used as a non-configurable analog input.

The values in the following table assumes that software compensates for errors in the analog to digital (A/D) converter.

CAN Shield

Description	Unit	Minimum	Maximum	Typical	Comment
Input impedance	—	—	—	0.68 µF + 1 Ω	—

Analog Input (5 V Only)

Description	Unit	Minimum	Maximum	Comment
Allowed voltage at pin	V	0	36	—
Measuring range	V	0	5.75	—
Resolution	mV	1.4		—
Worst case error	mV	±(20 + U*2%)		—
Input impedance	kΩ	233 ± 3		—

CAN Communication

CAN Communication

Description	Unit	Minimum	Maximum	Typical	Comment
Available baud rates	kBd	50	1000	50	With 120 Ω termination. The default baud rate is 250kbit.
				100	
				125	
				250	
				500	
				1000	
Maximum input voltage range	V	0	36	—	—

Gateway Channels

PLUS+1 GUIDE Service Tool can be connected to the CAN bus by using the following gateway channels.

Gateway Channels

Channel	Description
0	Display only
1	Display + CAN0
2	Display + CAN1
3	Display + CAN0+1
4	CAN0
5	CAN1
6	CAN0+1

Selecting channel zero will not increase CAN traffic because of the PLUS+1 GUIDE Service Tool communication.

Another PLUS+1 GUIDE Service Tool can be connected to the CAN bus by using the following gateway channels.

Simultaneous Usage Gateway Channels

Channel	Description
0	CAN[0] and CAN[1]
1 or 4	CAN[1]
2 or 5	CAN[0]
3 or 6	No CAN port

Memory

NV Memory

Caution

Non-volatile (NV) memory data loss is possible when the NV write cycle is not fully completed. When downloading a new application ensure data is not being written to NV memory.

FRAM Memory
DP7XX displays use Ferroelectric Random Access Memory (FRAM). FRAM has a write endurance of over 100 trillion cycles, that is ideal for datalogging. 2kB is available for application.

Vault Memory
DP7XX displays have 16 MB of flash vault memory (application logging memory). Application developers use this memory to log machine event data then use a USB stick or the PLUS+1 Service Tool to extract the logged data.

Accessing non-volatile or application log memory can delay the service tool scan.

Real Time Clock (RTC)

Parameter	Min	Max	Units
Backup Time	1		month
Drift		10	s/day

Product Ratings

Electrical

Supply Voltage

Description	Unit	Minimum	Maximum	Comment
DC supply voltage	V	9	36	With reverse polarity protection
DC supply current (circuit board only)	A	0	1	UBat = 14 V
		0	0.5	UBat = 28 V
Power supply interruption (without rebooting)	ms	—	—	200 ms

5 V Reference Output

Description	Unit	Minimum	Maximum
Output voltage	V	4.8	5.2
Output current	A	0	0.5
Output short circuit	A	—	1
Short circuit protection	V	0	36
Measuring of output voltage	V	0	5.75
Resolution	mV	1.4	
Worst case error	mV	± (20+U*2%)	

Warning

Output pins produce high voltage. High voltage can cause fire and/or electrical shock, if flammable gasses or chemicals are present, can cause an explosion. To protect against product damage and possible injury, do not exceed power supply voltage ratings and do not store this product where flammable gasses or chemicals are present.

Environmental

General

Description	Units	Minimum	Maximum	Comment
Operating temperature	˚C [˚F]	-30 [-22]	+60 [+140]	—
Storage temperature	˚C [˚F]	-30 [-22]	+80 [+176]	—
Ingress Protection (IP) rating	IP67			With mating connector installed and sealing plugs in unused connections.

Warning

Excessive high/low operating/storage temperatures can damage electronics. Damaged electronics can result in performance failure. To protect against product damage and possible injury, do not operate/store product in a environment that exceeds specified temperature ratings.

Testing Criteria

Climatic

Condition	Rating
Cold/heat storage and operation	IEC 60068-2-1, IEC 60068-2-2
Fogging	IEC 60068
Temperature change	IEC 60068-2-14
Moisture ingress	IEC 60529
Sunlight radiation	ISO 16750-4
Temp humidity voltage	IEC 60068-2-38

Chemical

Condition	Rating
Chemical resistance	ISO 16750-5

Mechanical

Condition	Rating
Vibration, resonance	IEC 60068-2-6
Vibration, operation	IEC 60068-2-64
Bump	IEC 60068-2-29
Shock	IEC 60068-2-27
Free fall	IEC 60068-2-32

Housing

Assembly

The housing comes pre-assembled.

Opening the display's housing voids the factory warranty.

Screen

Caution

Prolonged exposure to direct intense sunlight can cause premature failure of the LCD module. This risk can be reduced by providing shading or mounting the display at an incline rather than the horizontal.

There is protective glass over the display screen.

Caution

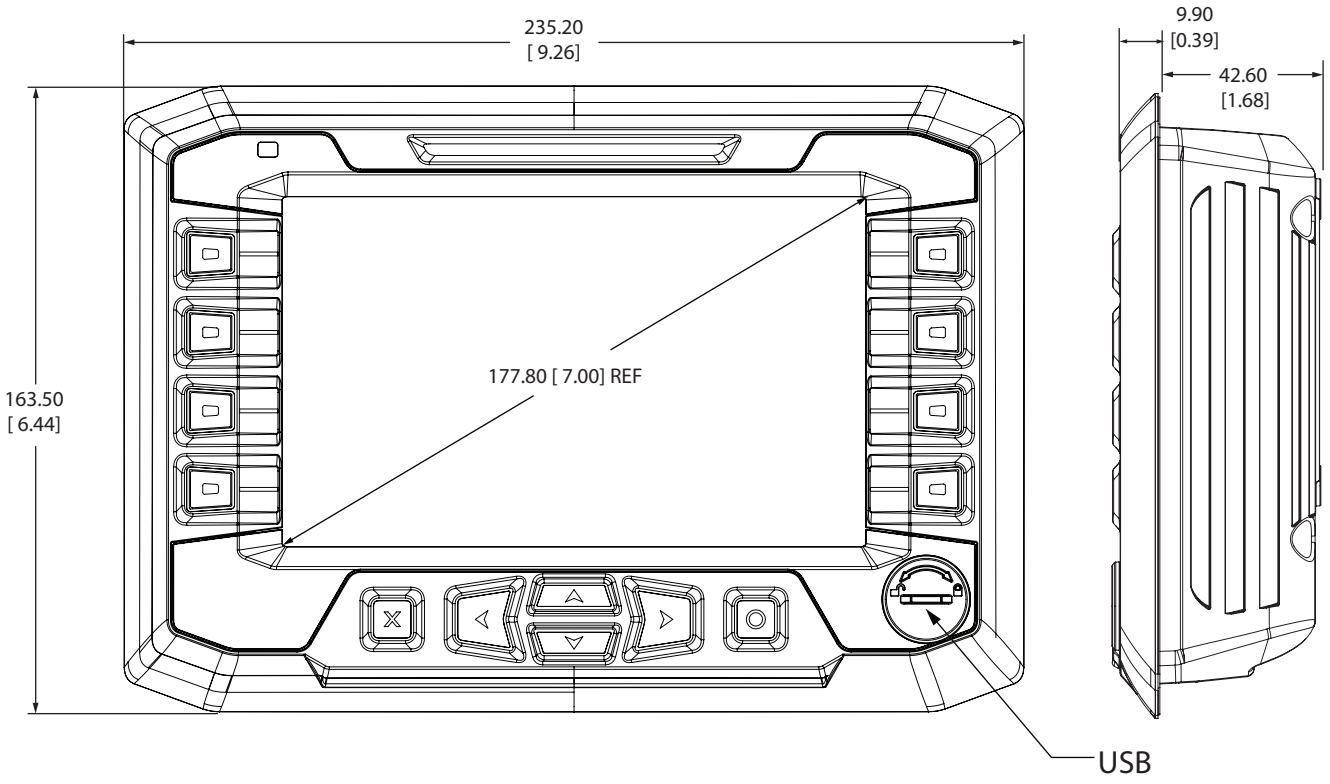
The protective glass will break if hit with a hard or heavy object. If the protective glass is broken, remove the display from your machine then return the display to Danfoss to be serviced.

Clean the display's housing and protective glass with a clean, soft, damp cloth, or mild dishwashing detergent because abrasive pads or solvents, including alcohol, benzene, and paint thinner can cause scratching and discoloration.

Installation

Dimensions

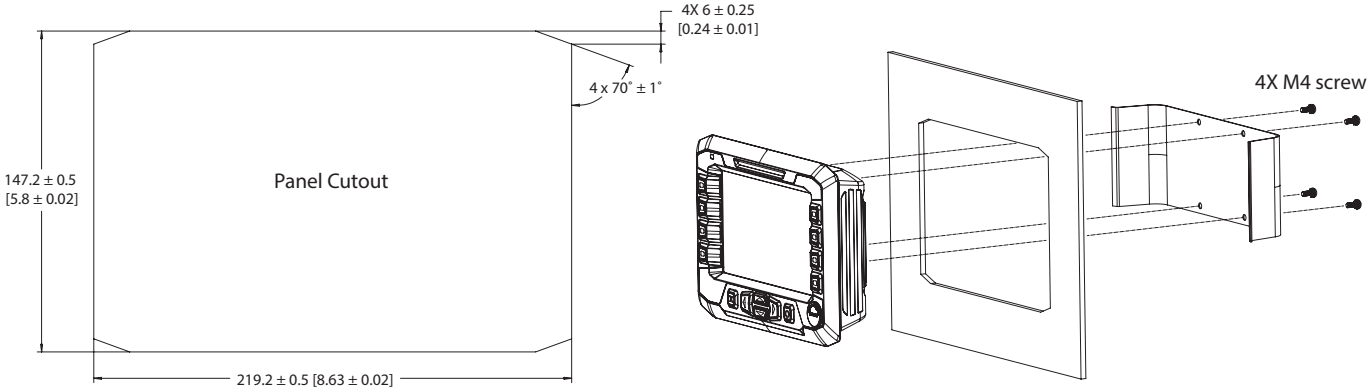
DP7XX in Millimeters [Inches]



Two Mounting Options

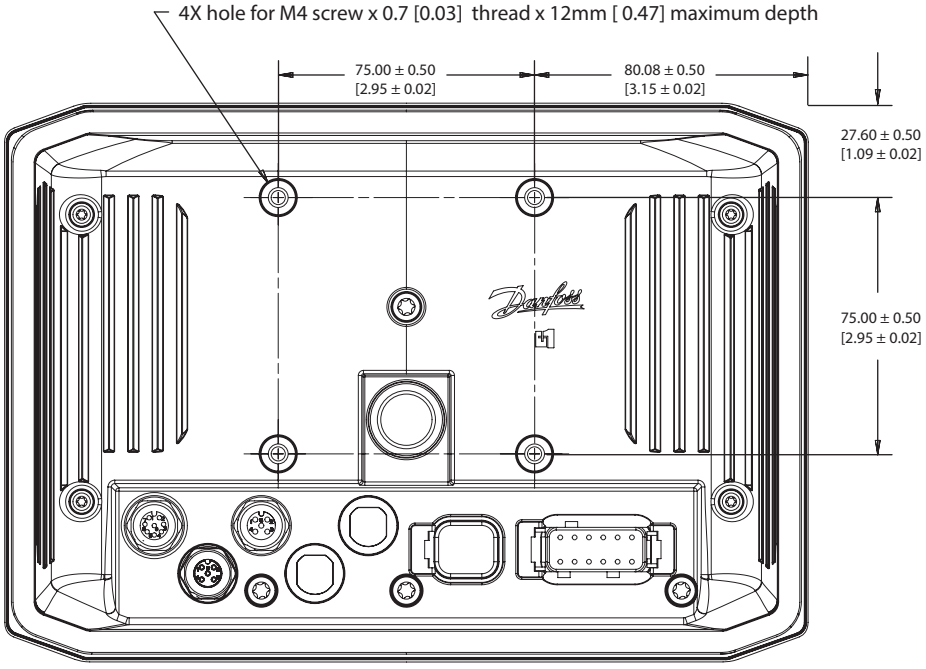
Flush Mounted

Use the Danfoss panel mounting kit (Danfoss part number 11144800) to flush-mount into a dashboard.



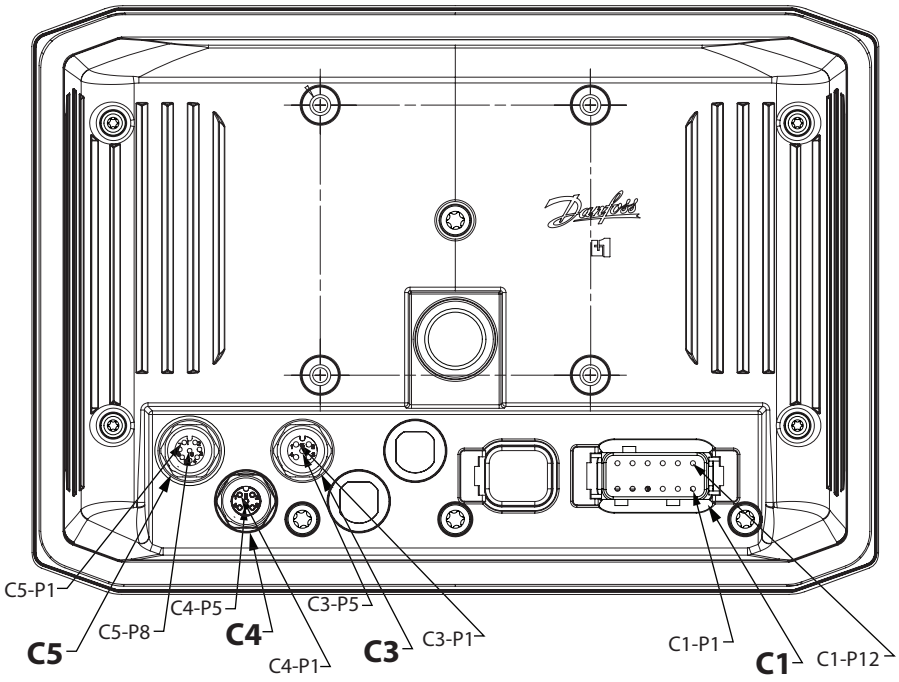
Stand-Alone On Post

Mount according to VESA (Video Electronics Standards Association) Mount Standards The VESA hole pattern for this display is: 75.00 mm x 75.00 mm (02.95 in x 02.95 in).

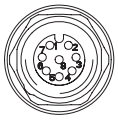


Disconnect your machine's battery power before connecting power and signal cables to the display.

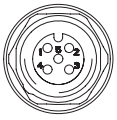
Pin Assignments



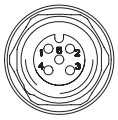
M12 8-pin



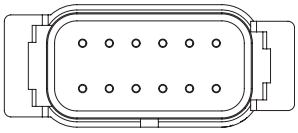
M12 5-pin



M12 5-pin



Deutsch® DTMO6 12-Pin

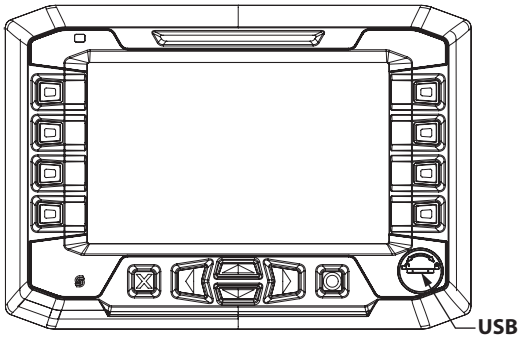


C5 Pin	Function
C5-P1	USB device Vbus
C5-P2	USB device D-
C5-P3	USB device D+
C5-P4	USB device GND
C5-P5	USB host GND/RS232 GND
C5-P6	USB host D+/RS232 RxD
C5-P7	USB host D-/RS232 TxD
C5-P8	USB host Vbus

C4 Pin	Function
C4-P1	Video power ground
C4-P2	Video power supply
C4-P3	Video signal input 2
C4-P4	Video signal input ground
C4-P5	NC

C3 Pin	Function
C3-P1	Video power ground
C3-P2	Video power supply
C3-P3	Video signal input 1
C3-P4	Video signal input ground
C3-P5	NC

C1 Pin	Function
C1-P1	Power ground -
C1-P2	Power supply +
C1-P3	CAN0 High +
C1-P4	CAN0 Low -
C1-P5	AIN/CAN Shield
C1-P6	CAN1 High +/(AIN/DIN)
C1-P7	CAN1 Low -/(AIN/DIN)
C1-P8	Sensor power/(AIN/DIN)
C1-P9	Sensor ground
C1-P10	Multifunction-input
C1-P11	Multifunction-input
C1-P12	DOUT



C6 Pin	Function
C6-P1	USB host VBus
C6-P2	USB host D-
C6-P3	USB host D+
C6-P4	USB host GND

The following guidelines are recommended when machine is equipped with a PLUS+1 mobile machine display.

Wiring

- 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.
- Power the analog sensors by the sensor power source from the module and ground returned to the sensor ground pin on the module.
- 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.

Ground electronic modules to a dedicated conductor of sufficient size that is connected to the battery (-).

Welding

Warning

Power and signal cables produce high voltage. High voltage can cause fire and/or electrical shock, if flammable gasses or chemicals are present, can cause an explosion. To protect against product damage and possible injury, before doing any electrical welding on a machine, disconnect all power and signal cables connected to the display.

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

Notes

Products we offer:

- Bent Axis Motors
- Closed Circuit Axial Piston Pumps and Motors
- Displays
- Electrohydraulic Power Steering
- Electrohydraulics
- Hydraulic Power Steering
- Integrated Systems
- Joysticks and Control Handles
- Microcontrollers and Software
- Open Circuit Axial Piston Pumps
- Orbital Motors
- PLUS+1® GUIDE
- Proportional Valves
- Sensors
- Steering
- Transit Mixer Drives

Danfoss Power Solutions is a global manufacturer and supplier of high-quality hydraulic and electronic 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. Building on our extensive applications expertise, we work closely with our customers to ensure exceptional performance for a broad range of off-highway vehicles.

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