

Revision History

Table of Revisions

Date	Page	Changed	Rev
11 Mar 2013	14	Added a note regarding the service tool scan	GA
28 Jan 2013	5	Added monochrome	FA
10 Nov 2012	6, 20	DP610LX input/output options; pin assignments	EA
19 Oct 2012	18	Typo on dimension drawings	DB
12 July 2012	5, 20	GPL-License statement, C2 Pin table	DA
25 May 2012	6	Model features	CA
08 May 2012	8	Typo	BB
26 April 2012	20	C4 Pin Function	BA
30 March 2012	4	Literature ID number corrected	AB
30 March 2012			AA

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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.

DP6XXLX Series PLUS+1 Mobile Machine Displays Reference Documents

Literature title	Literature type	Literature number
DP6XXLX Series PLUS+1 Mobile Machine Displays	Technical Information	L1209297
DP600LX Series PLUS+1 Mobile Machine Displays	Data Sheet	L1230993
DP610LX Series PLUS+1 Mobile Machine Displays	Data Sheet	L1222550
DP620LX Series PLUS+1 Mobile Machine Displays	Data Sheet	L1222211
PLUS+1 GUIDE Software User Manual	Operation Manual	10100824

Technical Literature is on line at: www.sauer-danfoss.com

Product Overview

DP6XXLX Series PLUS+1 Mobile Machine Displays

DP6XXLX Series graphical displays are designed to provide mobile machine OEMs with a rugged, high performing color and monochrome display for both in-cab and open usage.

The high resolution, thin film transistor liquid crystal (TFT) display with eight soft-keys and six buttons for navigation is user-programmable with PLUS+1 GUIDE (Graphical User Integrated Development Environment).

Use separate mechanical switches to implement critical safety features such as emergency stops.

Communication is done over a Controller Area Network (CAN) system.

GPL-License (General Public License)

The DP6xxLX 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://www.sauer-danfoss.com/Products/MobileElectronics/PLUS1Guide/PLUS1GuideDownloads/PLUS1GUIDEServiceToolSoftwareLicense/DownloadForm/DP600LXDownloadPage/index.htm>

User Liability and Safety Statements

OEM Responsibility

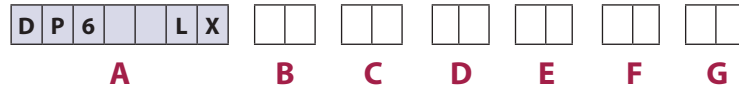
The OEM of a machine or vehicle in which a Sauer-Danfoss product is installed has the full responsibility for all consequences that might occur. Sauer-Danfoss has no responsibility for any consequences, direct or indirect, caused by failures or malfunctions.

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

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
DP600LX	09	02	06	02	04	00	11103049
DP610LX	10	02	06	02	04	00	11103051
DP620LX	10	02	06	02	04	01	11100065

A	<i>Model Name</i>	
	DP600LX	PLUS+1™ Mobile Machine Displays
	DP610LX	
	DP620LX	
B	<i>Input/Output Options</i>	
	09	2 CAN, 2 DIN/AIN/Freqin/Rheo/4-20mA In, 2 VideoIn
	10	2 CAN, 2 DIN/AIN/Freqin/Rheo/4-20mA In, 2 AIN/CAN Shield
C	<i>Real Time Clock/Low Temperature Functionality</i>	
	02	RTC
D	<i>Flash Memory/Application Key</i>	
	06	512 MB/without application key
E	<i>Application Log (Vault Memory)</i>	
	02	16 MB
F	<i>USB Port Type</i>	
	04	USB device, host/RS232 in rear
G	<i>Screen Size/Feature</i>	
	00	400 x 240 color transfective
	01	320 x 240 monochrome transfective

Related Products

Sauer-Danfoss Assembled Mating Connector Kits

DP6XXLX mating connector kit and contents	Part numbers
Mating connector kit	11109743
Connectors	
Binder 5-pin male (USB cable included)	10100728
Binder 8-pin male (USB cable included)	11109742
Deutsch DTM06-6S 6-pin	10103494
Deutsch DTM06-12SA 12-pin (16 to 20 AWG)	10102025
Deutsch DTM06-12SA 12-pin (20 to 24 AWG)	10100944
Terminal	
Binder and Deutsch	10100743
Crimp tool	
16 to 20 AWG	10100744
20 to 24 AWG	10100745
Locking plug	
6-pin Deutsch WM 6S	10100742
12-pin Deutsch WM 12S	10100741
IP 67 Seal Kit	
Deutsch	10103495
Binder	10103496
Deutsch mating connector kits and contents	Part numbers
6-pin connector kit	10103494
DTM06-6S 6-pin connector	10100739
12-pin connector kit (16 to 20 AWG)	10102025
DTM06-12SA 12-pin connector	10100738
12-pin connector kit (20 to 24 AWG)	10100944
DTM06-12SA 12-pin connector	10100738
Terminal	
Deutsch/Binder	10100743
Crimp tool	
16 to 20 AWG	10100744
20 to 24 AWG	10100745
Locking plug	
6-pin Deutsch WM 6S	10100742
12-pin Deutsch WM 12S	10100741
IP 67 seal kit	
Deutsch	10103495

Accessories

Description	Part number
Panel mounting kit	10101363
USB cable (device only)	10103497
USB cable (device and host)	11109121
Compact color camera, 12 V	10100831
PLUS+1 GUIDE Software Application (includes Service and Diagnostic Tool, and Screen Editor)	10101000

Inputs

DP6XXLX Series displays support the following pin types:

- Digital or Analog (DIN/AIN)
- Multifunction (DIN/AIN/FreqIN, Rheo, 4–20 mA)
- Analog or Temperature or Rheostat (AIN/Temp/Rheo)
- Fixed Range Analog or CAN shield (AIN/CAN shield)

DP6XXLX 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	>350	—
Resolution	mV	0.15		1 mV in software
Worst case error	mV	$\pm(0.15 + U*5/2\%)$		—
Input impedance	k Ω	230 \pm 5		To 0 V
Input impedance with pull-down	k Ω	15 \pm 2		To 0 V
Input impedance with pull-up	k Ω	15 \pm 2		To 5 V
Input impedance with pull-up/down	k Ω	7.5 \pm 1		To 2.5 V

Normal Range Multifunction Input

Description	Unit	Minimum	Maximum	Comment
Range	mV	0	>5.5	—
Resolution	mV	2		—
Worst case error	mV	$\pm(20 + U*2\%)$		—
Input impedance	k Ω	230 \pm 5		To 0 V
Input impedance with pull-down	k Ω	15 \pm 2		To 0 V
Input impedance with pull-up	k Ω	15 \pm 2		To 5 V
Input impedance with pull-up/down	k Ω	7.5 \pm 1		To 2.5 V

High Range Multifunction Input

Description	Unit	Minimum	Maximum	Comment
Range	mV	0	>60	—
Resolution	mV	30		—
Worst case error	mV	$\pm(300 + U*3.8\%)$		—
Input impedance	k Ω	105 \pm 5		To 0 V
Input impedance with pull-down	k Ω	15 \pm 2		To 0 V
Input impedance with pull-up	k Ω	15 \pm 2		To 5 V
Input impedance with pull-up/down	k Ω	7.5 \pm 1		To 2.5 V

**Inputs
 (continued)**

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	k Ω	230 \pm 5		To 0 V
Input impedance with pull-down	k Ω	15 \pm 2		To 0 V
Input impedance with pull-up	k Ω	15 \pm 2		To 5 V
Input impedance with pull-up/down	k Ω	7.5 \pm 1		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	k Ω	230 \pm 5		To 0 V
Input impedance with pull-down	k Ω	15 \pm 2		To 0 V
Input impedance with pull-up	k Ω	15 \pm 2		To 5 V
Input impedance with pull-up/down	k Ω	7.5 \pm 1		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 k Ω
		42		@ 10 k Ω
Source current	m	0	4	—

4–20 mA Input

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

This product does not have a Real Time Operating System (RTOS). Frequency inputs are managed by the operating system. Because of this you should avoid using these inputs for any type of Safety Critical closed loop control as the accuracy maybe affected by processor load. They should only be used for non-safety critical related functions.

Inputs (continued)

Multifunction (continued)

High Level Digital Input

Description	Unit	Minimum	Maximum	Typical	Comment
Voltage range	V	0	63	—	—
Input resistance	kΩ	—	—	105	No pull-up/down
				13	With pull-up to 5 V
				13	Pull-down to ground
				7	With pull-up and down to 5 V
Programmable low threshold voltage	V	0	63	—	—
Programmable high threshold voltage	V	0	63	—	—
Rise time	μs	—	—	20	—
Fall time	μs	—	—	20	—

High Level Analog Input

Description	Unit	Minimum	Maximum	Typical	Comment
Voltage range	V	0	63	—	—
Input resistance	kΩ	—	—	105	No pull-up/down
				13	With pull-up to 5 V
				13	Pull-down to ground
				7	With pull-up/down to 5 V
Analog voltage error (± 300 mV + U _{in} × 3.4%)	mV	—	—	± 100	U _{in} = 0 V
				± 2760	U _{in} = 70 V
Bandwidth	kHz	—	—	7.1	—

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.

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	70	—	—
Vbus output voltage	V	4.75	5.25	—	—
Vbus output current	A	—	—	0.5	—
Vbus short current	A	—	1.1	—	—

The DP6XXLX series displays all have USB ports that support memory sticks and computer connection. The DP6XXLX functions as a device when connected to a computer for diagnosis purposes or software download. The DP6XXLX functions as a host when a standard USB memory stick is connected so log-data can be transferred.

Other than supporting memory sticks and computer connection, the DP6XXLX 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	70	—	—
12 V output voltage (9 V < Ubat < 70 V)	V	11.5	12.7	12	—
12 V output current	A	—	—	0.5	Vbus < 5.25 V
24 V output voltage (9 V < Ubat < 70 V)	V	23	26	24	—
24 V output current	A	—	0.5	—	—
External video inputs	—	—	—	—	Both NTSC and PAL support

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	—	—	—	1 μ F + 1 Ω	—

Analog Input (5 V Only)

Description	Unit	Minimum	Maximum	Comment
Allowed voltage at pin	V	0	70	—
Measuring range	V	0	> 5.5	—
Resolution	mV	2		—
Worst case error	mV	$\pm(20 + U*2\%)$		—
Input impedance	k Ω	230 \pm 5		—

CAN Communication

CAN Communication

Description	Unit	Minimum	Maximum	Typical	Comment
Available baud rates	kBd	50	1000	50	With 120 Ω termination
				100	
				125	
				250	
				500	
				1000	
Maximum input voltage range	V	0	70	—	—

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	DP600 only
1	DP600 + CAN0
2	DP600 + CAN1
3	DP600 + 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

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

DP6XXLX displays use Ferroelectric Random Access Memory (FRAM). FRAM has a write endurance of over 100 trillion cycles, that is ideal for datalogging.

Vault Memory

DP6XXLX displays have 16 MB of serial 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.

Electrical

Supply Voltage

Description	Unit	Minimum	Maximum	Comment
DC supply voltage	V	9	63	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	70

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]	70 [158]	—
DP620LX	°C [°F]	-20 [-4]	70 [158]	—
Storage temperature	°C [°F]	-40 [-40]	85 [185]	—

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 visibility	IEC 68-2-5

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

Assembly

The housing comes pre-assembled. PLUS+1 mobile machine displays feature a snap together assembly that is tamper-proof.

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.

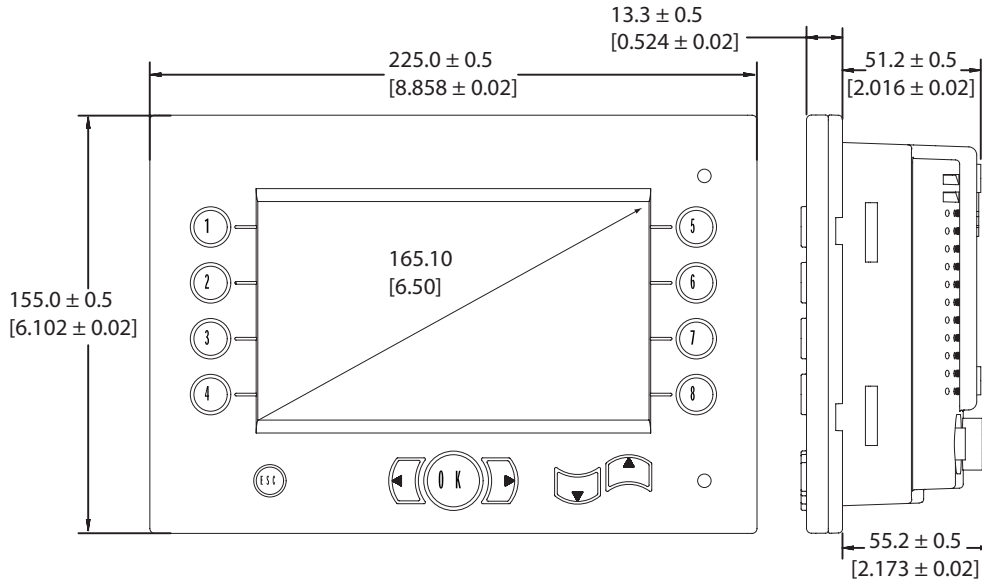
ⓘ Caution

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 Sauer-Danfoss to be serviced.

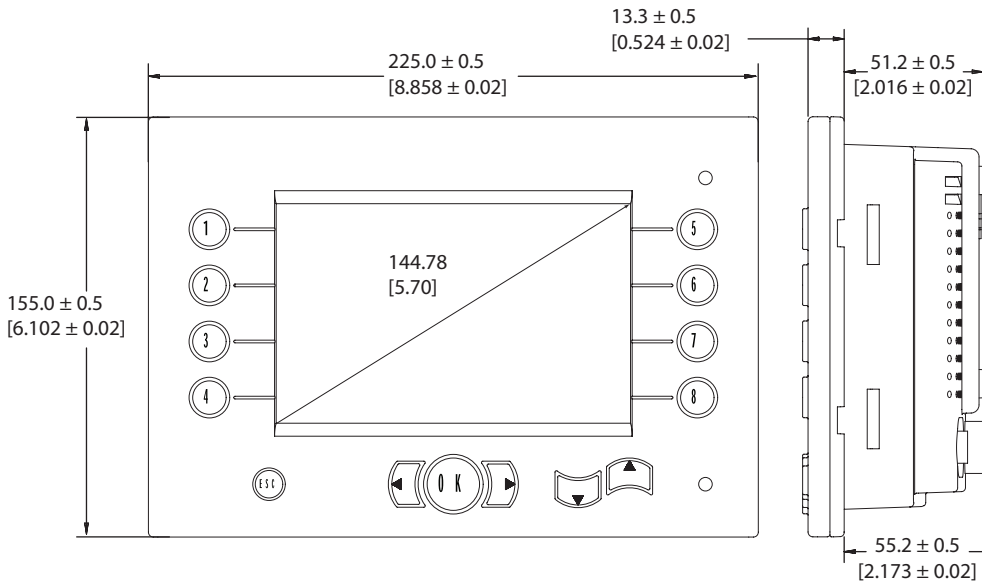
Clean the display's housing and protective glass with a clean, soft, damp cloth, or mild dishwashing detergent because abrasive pads or solvents, including alcohol, benzene, and paint thinner can cause scratching and discoloration.

Dimensions

DP600LX and DP610LX



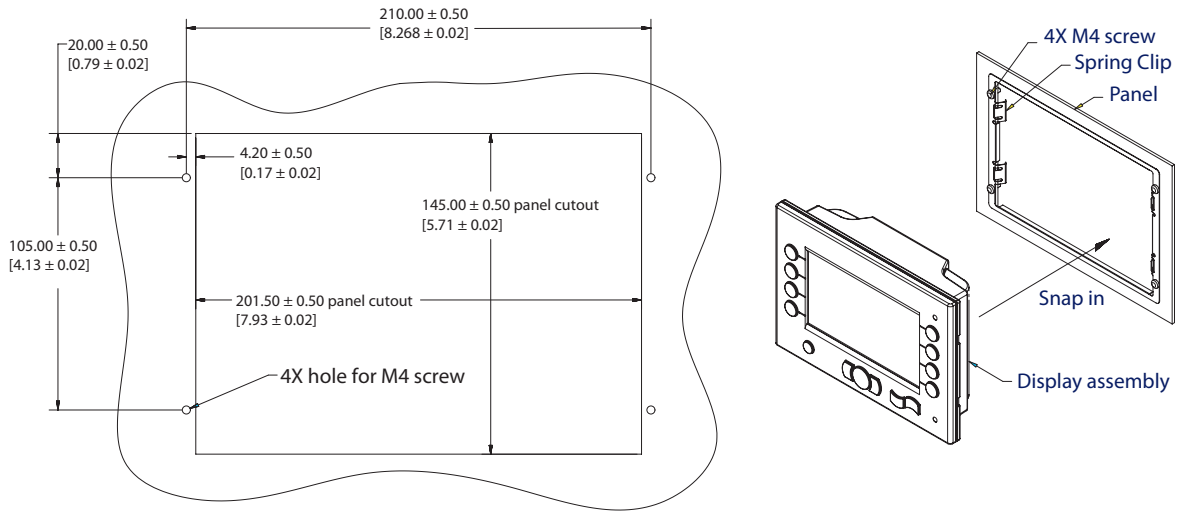
DP620LX



Two Mounting Options

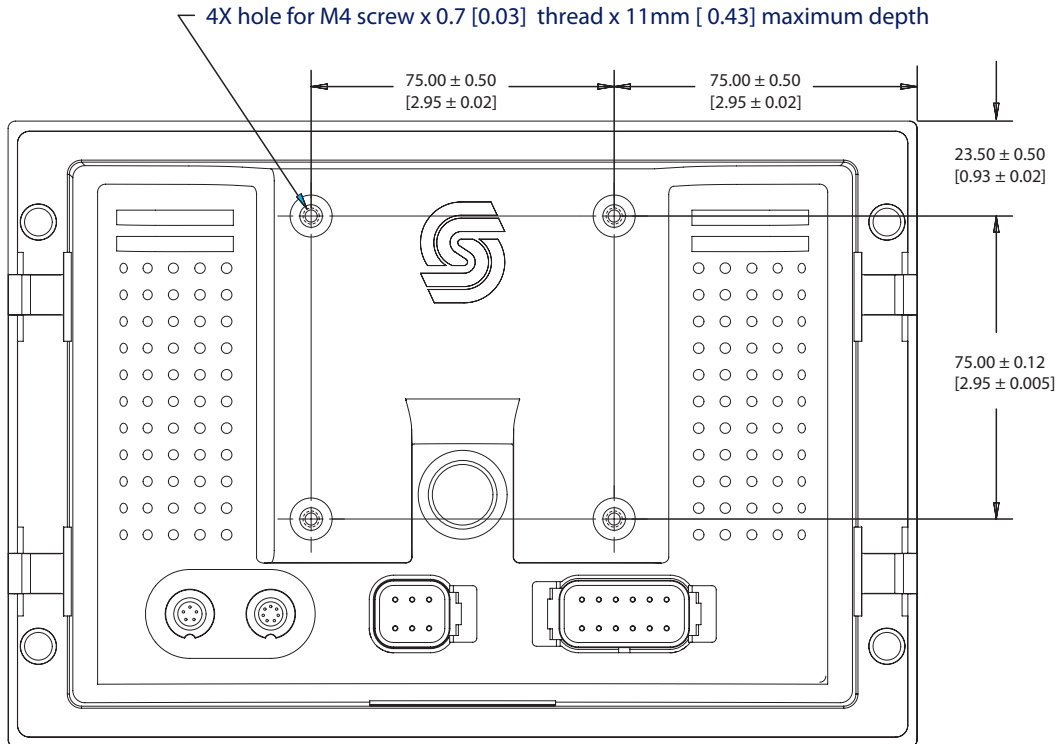
Flush Mounted

Use the Sauer-Danfoss spring clip frame to flush-mount into a dashboard.



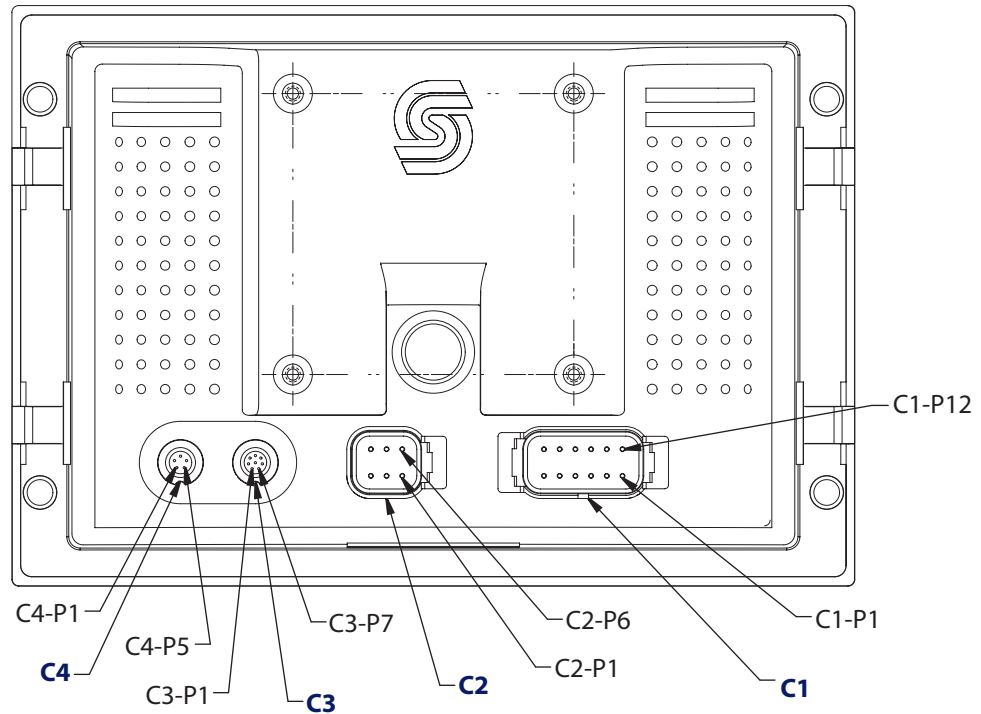
Stand-Alone On Post

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).

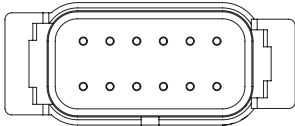


Disconnect your machine's battery power before connecting power and signal cables to the display.

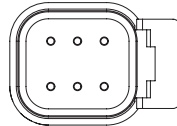
Pin Assignments



Deutsch® DTMO6 12-Pin



Deutsch DTMO6 6-Pin



Binder 702 Series USB 8-Pin



Binder 702 Series 5-Pin



C1 Pin	Function
C1-P1	Power ground -
C1-P2	Power supply +
C1-P3	CAN1 High +
C1-P4	CAN1 Low -
C1-P5	AIN/ CAN shield
C1-P6	CAN0 High +
C1-P7	CAN0 Low -
C1-P8	Sensor supply
C1-P9	Multifunction-input
C1-P10	Multifunction-input
C1-P11	Analog/Digital input
C1-P12	Digital output

C2 Pin	Function
C2-P1	Battery ground
C2-P2	Redundant power supply
C2-P3	NC
C2-P4	NC
C2-P5	CAN shield/ AIN
C2-P6	Digital/ AIN

C3 Pin	Function
C3-P1	USB device Vbus
C3-P2	USB device data -
C3-P3	USB device data +
C3-P4	USB device ground
C3-P5	USB host ground/ RS232
C3-P6	USB host data +/- RS232 Rx/D
C3-P7	USB host data - /RS232 Tx/D
C3-P8	USB host Vbus

C4 Pin	Function
C4-P1	Power ground
C4-P2	Supply power
C4-P3	Video 1 In
C4-P4	Signal ground
C4-P5	Video 2 In

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

Wiring

1. All wires must be protected from mechanical abuse. Wires should be run in flexible metal or plastic conduits.
2. Use 85° C [185° F] wire with abrasion resistant insulation. 105° C [221° F] wire should be considered near hot surfaces.
3. Use a wire size that is appropriate for the module connector.
4. Separate high current wires such as solenoids, lights, alternators or fuel pumps from sensor and other noise-sensitive input wires.
5. 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.
6. Do not run wires near sharp metal corners. Consider running wires through a grommet when rounding a corner.
7. Do not run wires near hot machine members.
8. Provide strain relief for all wires.
9. Avoid running wires near moving or vibrating components.
10. Avoid long, unsupported wire spans.
11. All analog sensors should be powered by the sensor power source from the PLUS+1 controller and ground returned to the sensor ground pin on the PLUS+1 controller.
12. Sensor lines should be twisted about one turn every 10 cm [4 in].
13. It is better to use wire harness anchors that will allow wires to float with respect to the machine rather than rigid anchors.
14. Electronic modules should be grounded 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. The engine should be off.
2. Disconnect the negative battery cable from the battery.
3. 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 a possible to the weld.



DP6XXLX Series PLUS+1 Mobile Machine Displays
Technical Information
Notes



- 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

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