PANELWARE HARDWARE AND INSTALLATION MANUAL

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3. Display Modules

4. Keypad Modules

5. Panel Controllers

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CHAPTER 1
SYSTEM OVERVIEW

1 System Overview

This chapter provides a basic description of operator panels and gives the user an overview of the possibilities offered by the PANELWARE operator panels.

- Operator Panel Basics
  - General Information
  - Operator Panel Components
  - Operation
- PANELWARE Operator Panels
  - The Modular Concept
  - Display Modules
  - Keypad Modules
  - Panel Controllers
  - Compact and Micro HMI
- PANELWARE Operator Panel Connection
  - Panel ↔ PLC
  - Operator Panel Expansion
- Programming PANELWARE Operator Panels
  - Non-intelligent Panel Controllers
  - Intelligent Panel Controllers
  - Intelligent Panel Expansion (C300)
- Order Information
- Dimensions and Installation

2 Operator Panel Basics

2.1 General Information

The visualization of applications and diagnosis by means of visual aids has become one of the most important developing factors in automation technology. Visualization devices are the means of communication between man and his machines. They are the means of entering accurate machine parameters as well as displaying the status of various operations throughout a process application. Applications involving visualization and automation tasks are being completed effectively by a wide range of full terminals to moderate and low cost smaller operator panels.

	Panel	Terminal
Display Type Size Character Size	Mainly line displays LCD, VFD, EL or TFT displays Depends on the amount of lines Approx. 4 to 15 mm	Mainly semi or full-graphic monitors CRT, EL or TFT displays Mainly 12" or 14" CRT screens ----
Unit Size	Panels are smaller and more compact than terminals.	
Unit Depth	Panels generally have a shallow depth in comparison with terminals. The mounting depth of terminals with an EL or TFT display is on average somewhere between that of panels and of terminals with CRT displays.	
Weight	Panels are distinguished by their light weight above all else.	

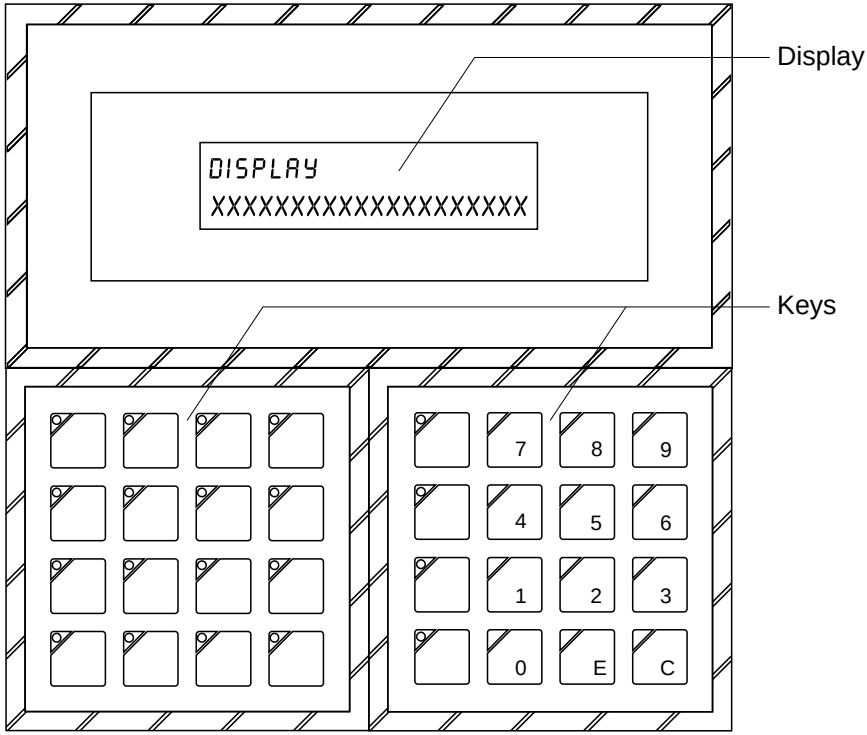
The Advantages of Operator Panels:

- ❒ Compact structure
- ❒ Light weight
- ❒ Shallow mounting depth
- ❒ More robust than terminals

A wide range of operator panels are required to visualize and control industrial applications. Cost, size and efficiency are a few of the criteria examined in the process of choosing the right panels for an application. The large selection however doesn't always provide the answer. Modular panels which can be configured and combined to suit the user's wishes are, in the end, the optimal solution.

2.2 Operator Panel Components

From the outside the user sees a panel as consisting of a combination of the two components **keys** and **display**.



2.3 Operation

The way that a panel is put into operation depends on whether it is an ***intelligent*** or a ***non-intelligent*** panel.

Non-intelligent panels must be operated through control sequences from the PLC. The PLC must, in this case, take over display and keypad management. By means of these control sequences characters (letters, numbers, ...) or graphics can be displayed on the screen. The panel indicates, again by means of control sequences, which keys are pressed.

Intelligent panels are completely selfsufficient in their keypad and display management. A dedicated processor takes over the task of displaying data on the display. This processor handles the visualization of PLC data in the form of animated bar graphs, lists, diagrams or messages. The panel responds to pressed keys and the reaction is either caused within the panel or in the PLC. For example, an intelligent panel can display the exact same data in different forms. The PLC only sends the data. The panel modifies the data into the desired format and delivers it to the user over the display. Intelligent panels save on PLC processing requirements.

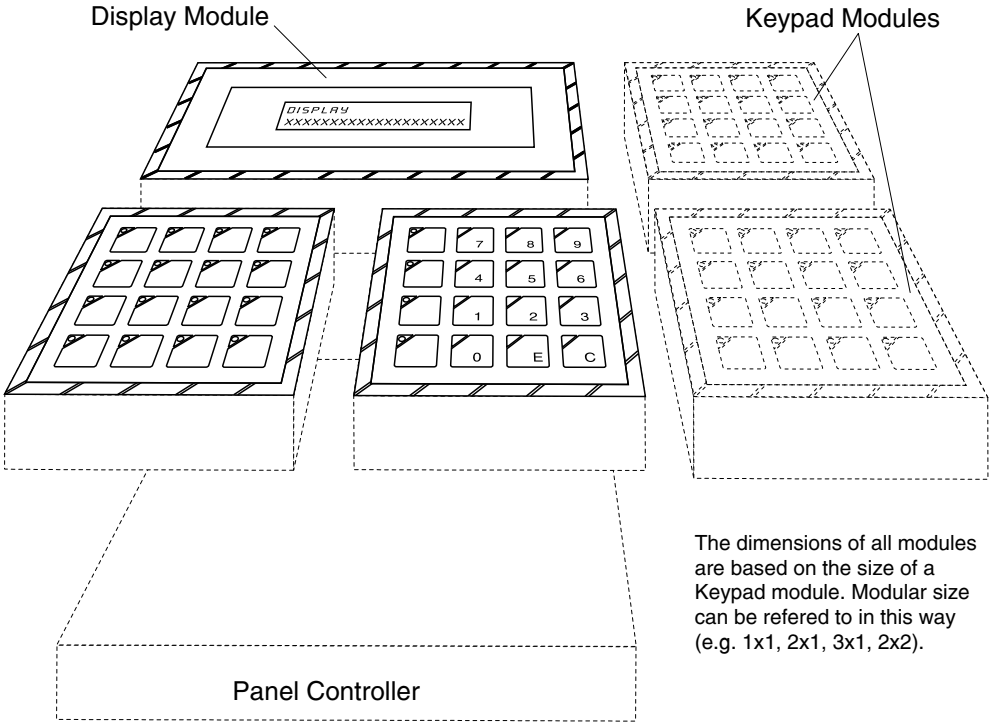
3 PANELWARE Operator Panels

3.1 The Modular Concept

PANELWARE Operator Panels are based upon a Modular structure, which permits combinations of different sizes of displays, different amounts of keys and the processing efficiency that is required and all set up directly according to the user's wishes.

Every PANELWARE panel consists of three basic elements:

- ❒ 1 Display Module
- ❒ 1 Panel Controller
- ❒ Keypad Modules (maximum seven)



The dimensions of all modules are based on the size of a Keypad module. Modular size can be refered to in this way (e.g. 1x1, 2x1, 3x1, 2x2).

The concept of the modular construction provides the user with an abundance of panel variations from which a suitable combination can be picked out and configured to fit the requirements of his/her application.
This modular structure covers the majority of requirements within the range of industrial applications.

3.2 Display Modules

- LCD Display Modules
  - 2 x 20 LCD Display Module
  - 4 x 20 LCD Display Module
  - 4 x 40 LCD Display Module
- VFD Display Modules
  - 2 x 20 VFD Display Module
  - 2 x 40 VFD Display Module
- Graphics Display Modules
  - Graphics Display Module (64 x 240 pixels)
  - Graphics Display Module (128 x 240 pixels)
  - Graphics Display Panel, Horizontal (128 x 240 pixels)
  - Graphics Display Panel, Vertical (128 x 240 pixels)

3.3 Keypad Modules

- Standard Keypad Modules
  - 16 Keys
  - 12 +4 Keys
  - 8 Keys
  - 4 Keys
- Special Keypad Modules
  - Dummy Module
  - E-Stop Button
  - Key Switch
  - Start/Stop

Key modules **EMERGENCY STOP**, **Key Switch**, **Start/Stop** and **Dummy Module** are special modules which conform to the same standards and design as all other PANELWARE modules. These cannot however be connected with other modules or the panel controller.

3.4 Panel Controllers

- Non-intelligent Panel Controllers
  - C100 Panel Controller
  - C110 Panel Controller
  - C130 Panel Controller
- Intelligent Panel Controllers
  - C200 Panel Controller
  - C220 Panel Controller
  - C221 Panel Controller
  - C300 Panel Controller

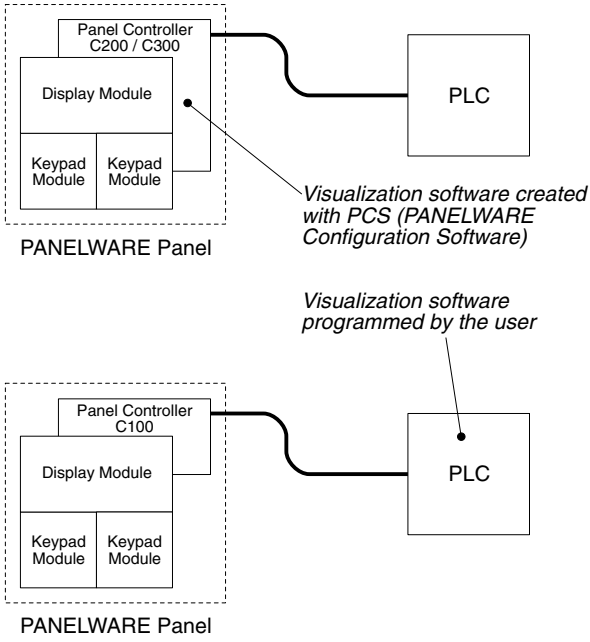
3.5 Compact and Micro HMI

- Compact HMI
  - P120 Compact HMI
  - P121 Compact HMI
- Compact HMI
  - P125 Compact HMI
  - P126 Compact HMI
- Micro HMI
  - P150 Micro HMI

4 PANELWARE Operator Panel Connection

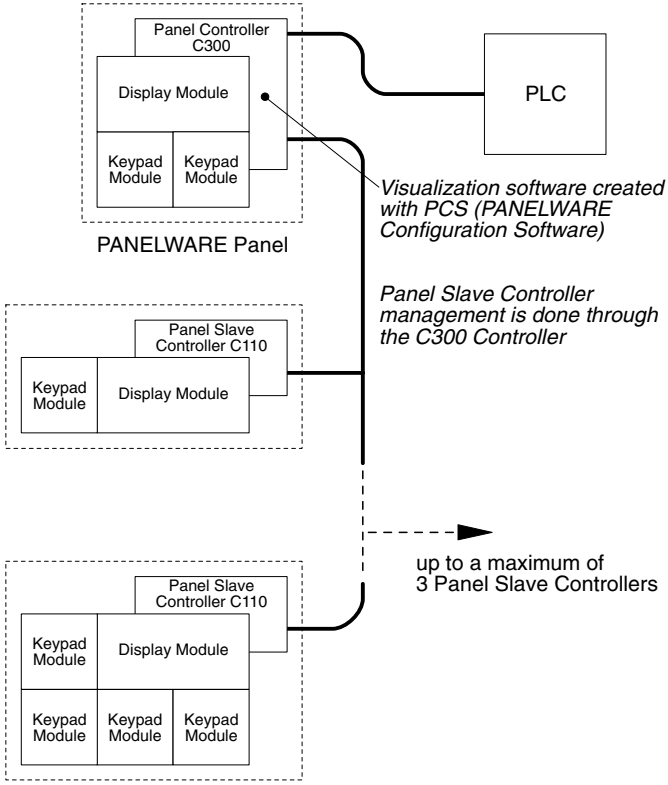
4.1 Panel ↔ PLC

Panels having controllers C100, C200, C220, C221 or C300 can be linked directly with a PLC.



4.2 Operator Panel Expansion

A panel with a C300 controller can be expanded so that up to an additional three display modules (including a maximum of seven Keypad modules) can be connected by means of a C110 Panel-Slave-Controller.



5 Programming PANELWARE Operator Panels

PANELWARE Operator Panel programming is basically divided into two separate areas. Panels with non-intelligent controllers and panels with intelligent controllers.

5.1 Non-intelligent Panel Controllers

C100, C110, C130, P121, P126 Panel Controller: The visualization (display of PLC data in different formats) and the keypad functionality must be controlled from the PLC. Data exchange is done by means of control sequences which correspond to an expanded VT100 command set.

5.2 Intelligent Panel Controllers

C200, C220, C221, C300, P120, P125, P150 Panel Controllers: The complete visualization and management of keypad functionality is handled by the panel controller. A program is created with the PCS (PANELWARE Configuration Software) running on a PC which is transferred to the panel controller. This program takes care of the data exchange between the PLC (data is written to or read from the PLC) and the display/keys. PANELWARE projects can also be created and transferred to the panel controller using B&R's PCC Software.
C300 Panel Controller: Up to three Panel-Slave-Controllers can be connected to this controller. These slaves are controlled through a program in the master (C300) which is defined in PCS.

5.3 Intelligent Panel Expansion (C300)

A C300 panel controller can be expanded with the **C110 Panel Slave Controller**. The C110 Slave Controller is controlled by an intelligent panel (C300).

6 Order Information - Model Numbers

Display Modules	Blue	Black
Display Module 2 x 20 LCD	4D1022.00-090	4D1022.00-590
Display Module 4 x 20 LCD	4D1042.00-090	4D1042.00-590
Display Module 4 x 40 LCD	4D1044.00-090	4D1044.00-590
Display Module 8 x 40 LCD	4D1084.00-090	4D1084.00-590
Display Module 16 x 40 LCD	4D1064.00-090	4D1064.00-590
Display Panel 16 x 40 LCD, horizontal	-	4D1065.00-590
Display Panel 16 x 40 LCD, vertical	-	4D1066.00-590
Display Module 2 x 20 VFD	4D2022.00-090	4D2022.00-590
Display Module 2 x 40 VFD	4D2024.00-090	4D2024.00-590

Keypad Modules	Blue	Black
Keypad Module - 16 keys	4E0010.01-090	4E0011.01-590
Keypad Module - 12 + 4 keys	4E0020.01-090	4E0021.01-590
Keypad Module - 8 keys	4E0030.01-090	4E0031.01-590
Keypad Module - 4 keys	4E0040.01-090	4E0041.01-590
Keypad Module - Blank module	4E0050.01-090	4E0050.01-590
Keypad Module - EMERGENCY STOP	4E0060.01-090	4E0060.01-590
Keypad Module - Key switch	4E0070.01-090	4E0070.01-590
Keypad Module - Start/Stop	4E0080.01-090	4E0080.01-590

Panel Controller	Blue	Black
Panel Controller C100	4C1000.01-010	4C1000.01-510
Panel-Slave-Controller C110	4C1100.01-010	4C1100.01-510
Panel Controller C130	-	4C1300.01-510
Panel Controller C200	4C2000.01-010	4C2000.01-510
Panel Controller C220	4C2200.01-010	4C2200.01-510
Panel Controller C221	-	4C2210.01-510
Panel Controller C300	4C3000.01-110	4C3000.01-510

Compact and Micro HMI	Blue	Black
P120 Compact HMI	-	4B1200.00-590
P121 Compact HMI	-	4B1210.00-590
P125 Compact HMI	-	4B1250.00-590
P126 Compact HMI	-	4B1260.00-590
P150 Micro HMI	4B1500.00-090	4B1500.00-590

The components and extras which are delivered with each individual module are listed in the corresponding chapter (***Display Modules***, ***Keypad Modules*** or ***Panel Controllers***).

7 Dimensions and Installation

Matrix size	Product Dimensions	Cutout Dimensions [1)]
1	96 mm	92 mm
2	192 mm	188 mm
3	288 mm	284 mm
4	384 mm	380 mm
[1)] Tolerances: -0 mm +0.5 mm		

Example: 3 x 2 Operator panel

l ..... Length = 288 mm
w ... Width = 192 mm
Cutout Dimensions = 284 x 188 mm

Note:
Measurements are generally given in metric units in this manual. However, there are metric to imperial conversion tables provided on the last page of this publication.

CHAPTER 2
SYSTEM ASSEMBLY

1 System Assembly

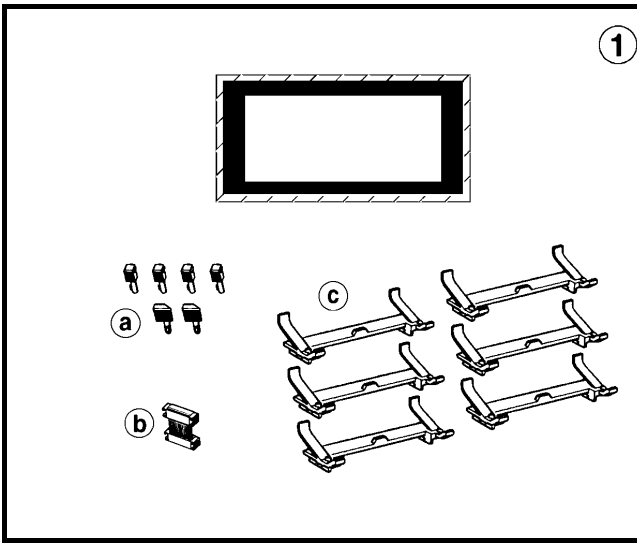
This chapter is an overall description of how to assemble PANELWARE system components to suit your application.

- Inserting / Exchanging Keypad Labels
- Panel Assembly
- Panel Installation
- Panel Removal
- Panel Disassembly
- Installing / Replacing Battery

2 Package Contents

Depending on the ordered module, the package received includes the respective amount of accessory components.

2.1 Display Module Type 1

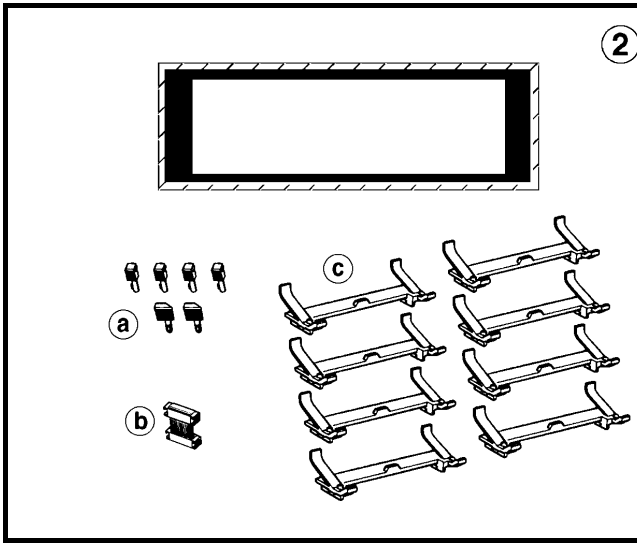


a Mounting pins

b Ribbon cable

c Spring clips

2.2 Display Module Type 2

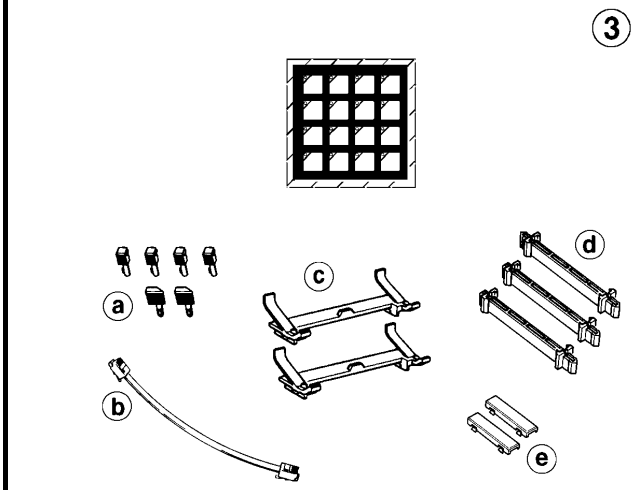


a Mounting pins

b Ribbon cable

c Spring clips

2.3 Keypad Module



a Mounting pins

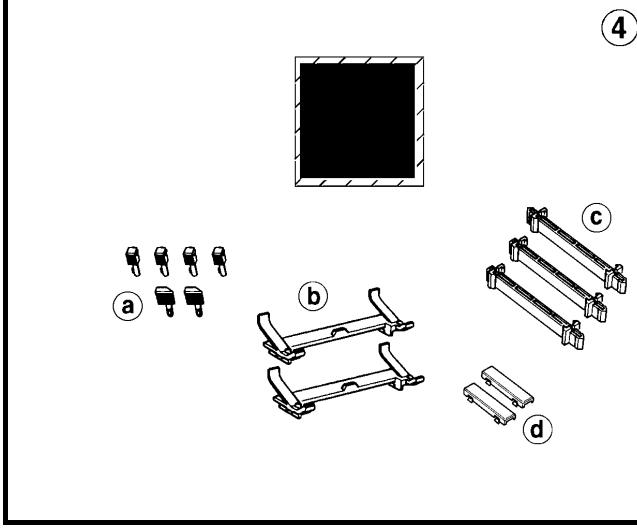
b Short keyboard cable

c Spring clips

d Module connectors

e Cable covers

2.4 Special Keypad Modules



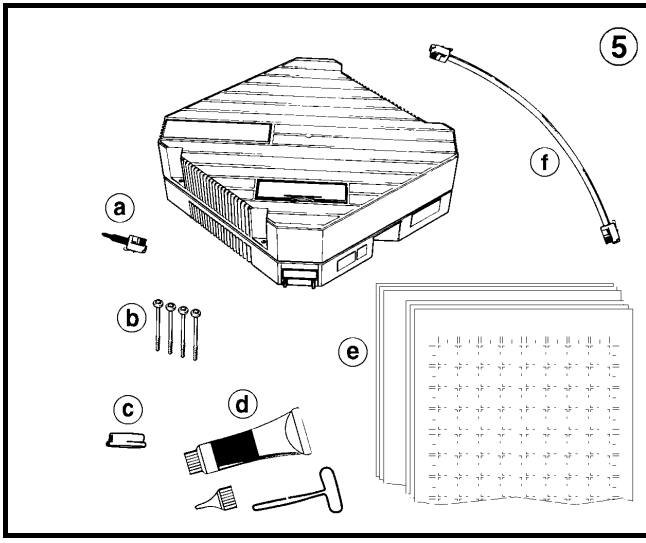
a Mounting pins

b Spring clips

c Module connectors

d Cable covers

2.5 Panel Controller C200 or C300



a Termination resistor

b Screws

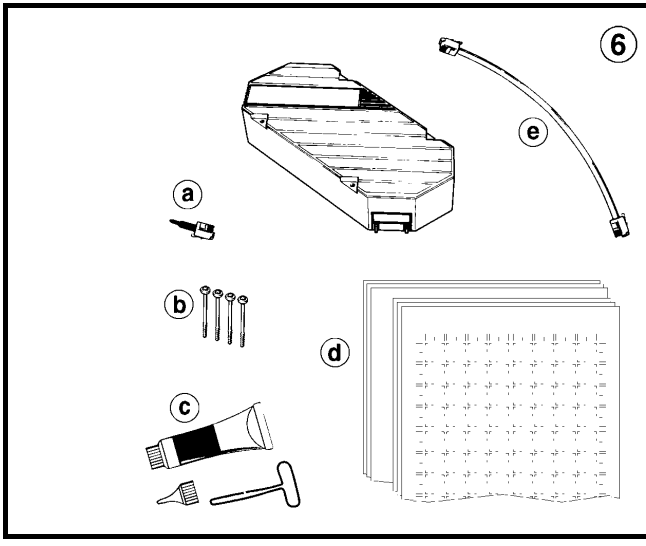
c Battery

d Sealant tube with application nozzle and squeezing tool

e Keypad labels

f Long keyboard cable

2.6 Panel Controller C100 or C110



a Termination resistor

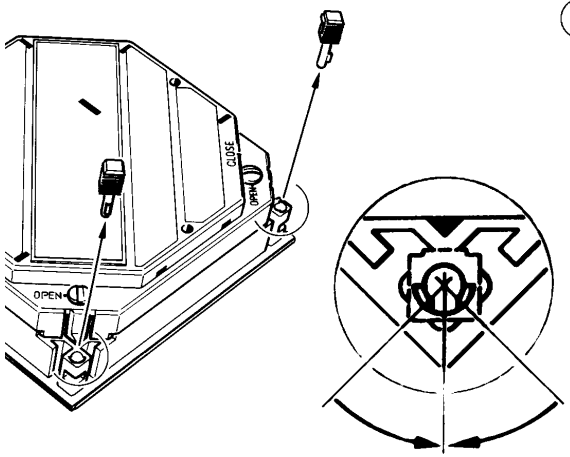
b Screws

c Sealant tube with application nozzle and squeezing tool

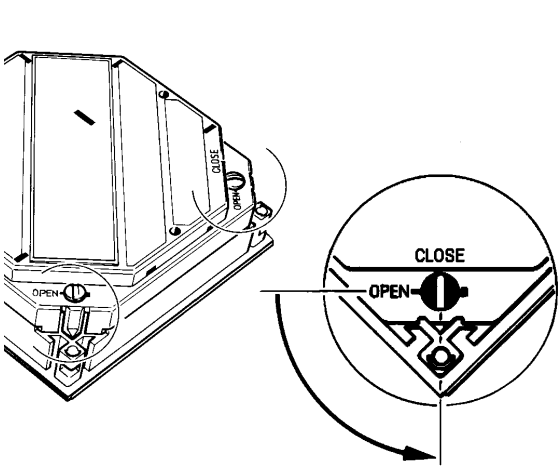
d Keypad labels

e Long keyboard cable

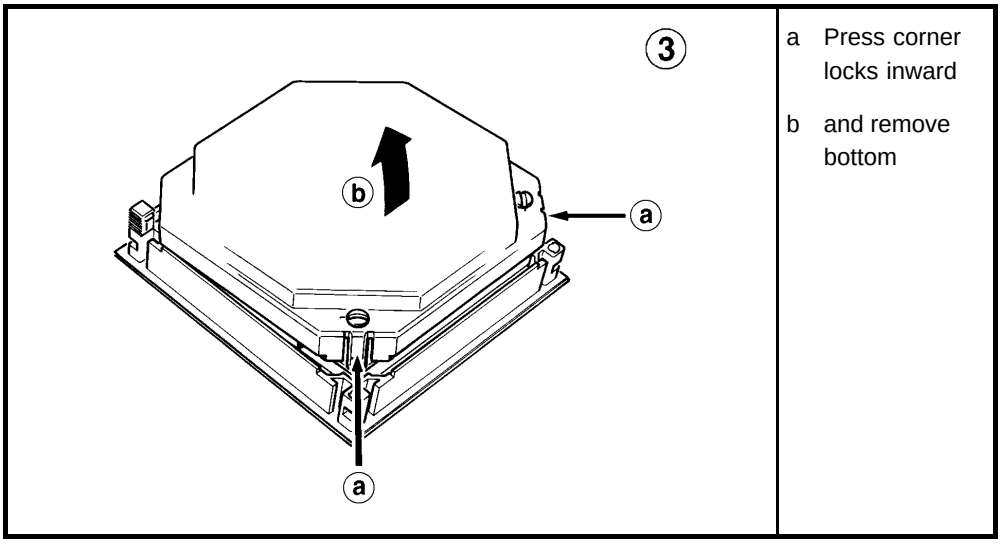
3 Inserting / Exchanging Keypad Labels



Remove mounting pins

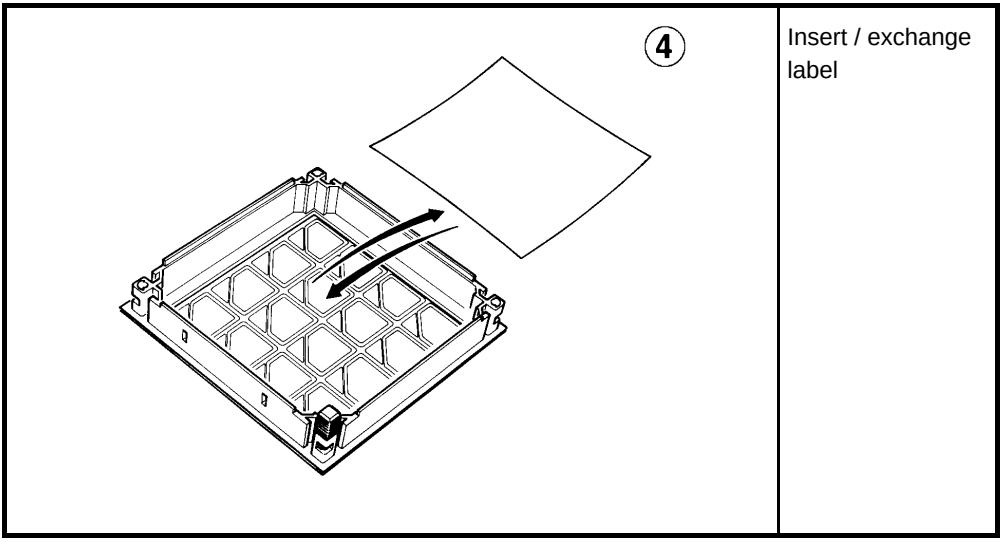


Turn screw locks to the OPEN position

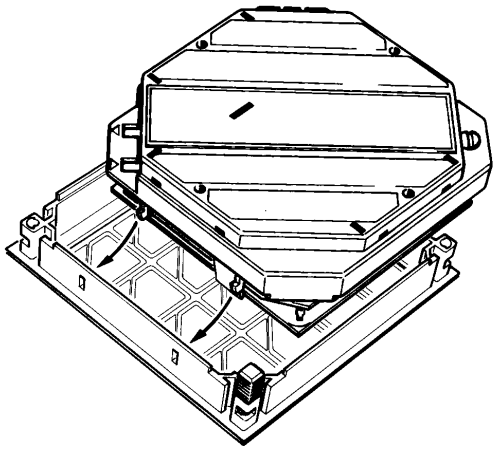


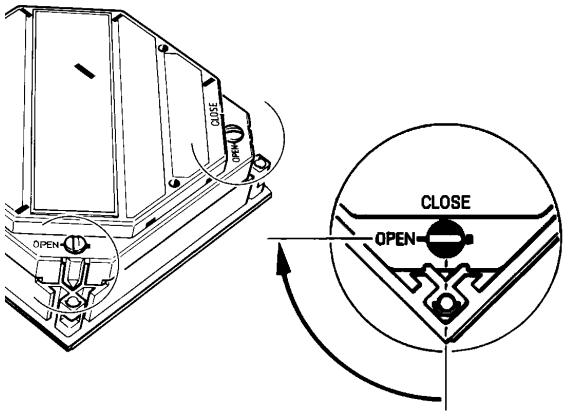
a Press corner locks inward

b and remove bottom

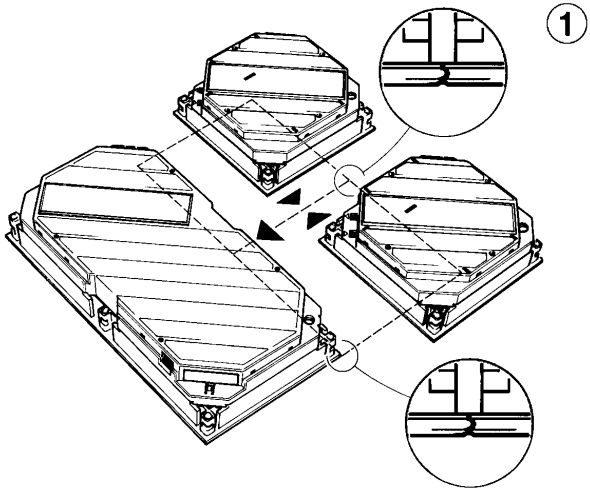


Insert / exchange label

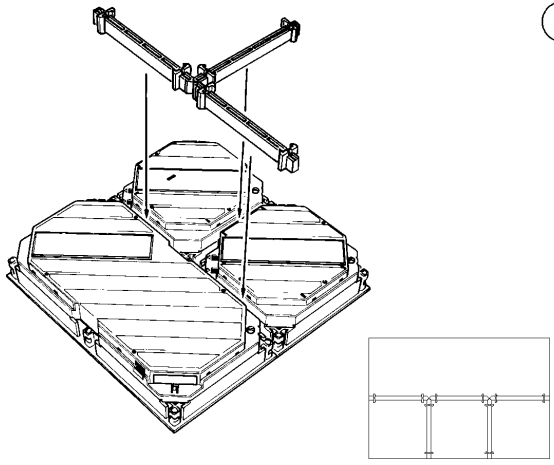
⑤ 	Replace bottom

⑥ 	Turn screw locks to CLOSE position

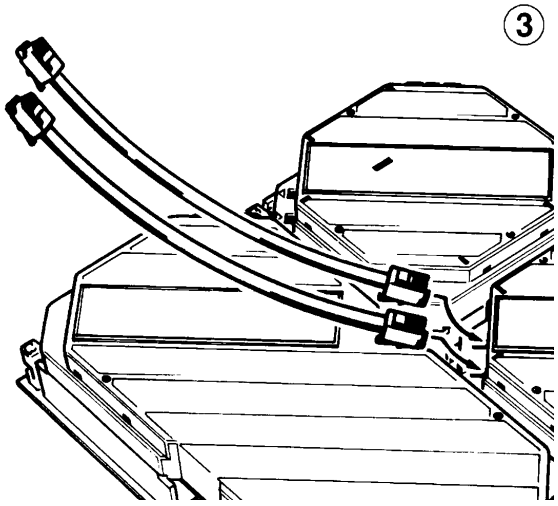
4 Panel Assembly



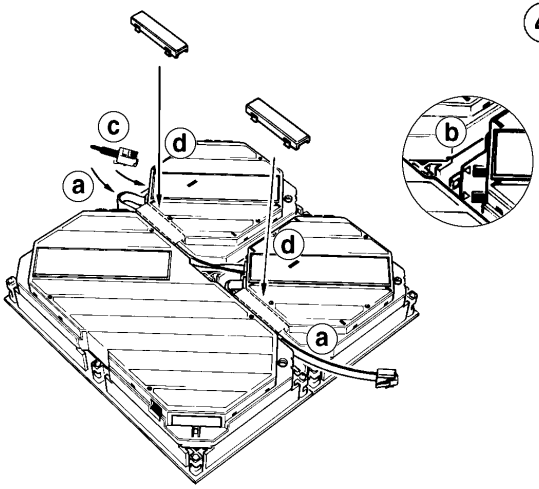
Lay module components upside down in their respective positions



Insert module connectors and press firmly into place



Connect keyboard cables firmly

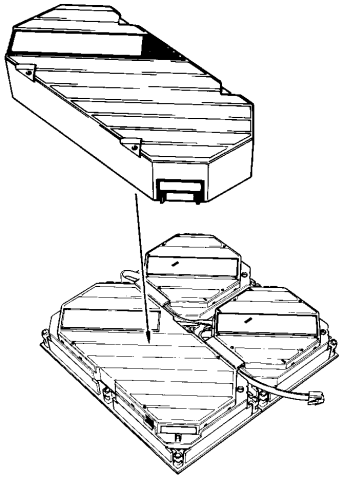


a Connect Keypad modules

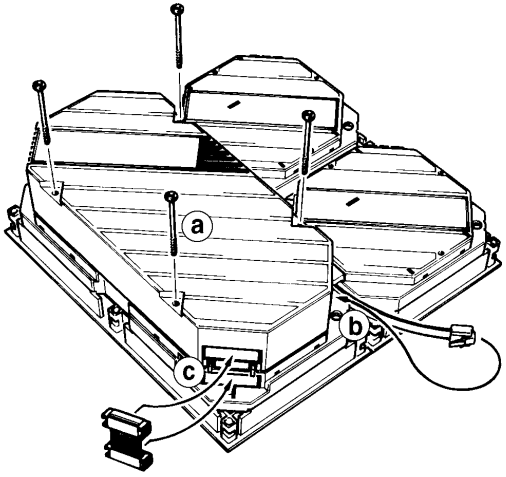
b Do not switch outputs and inputs

c Connect termination resistor to output of last Keypad module

d Insert cable covers



Set controller in place

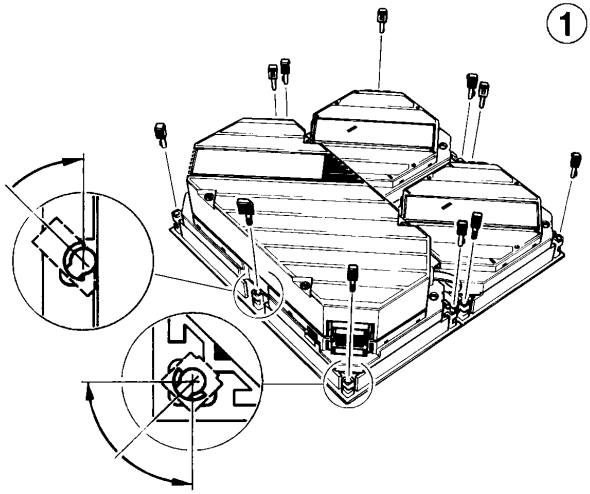


a Fix controller with screws

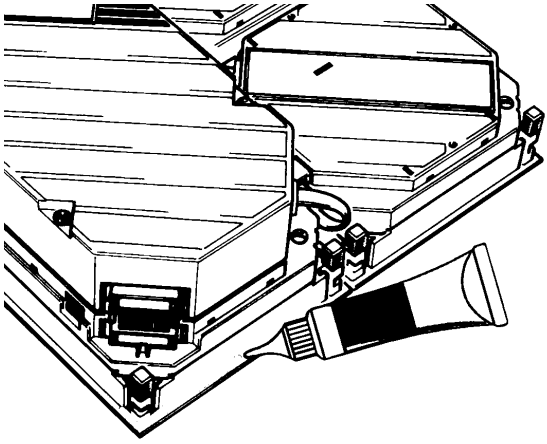
b Connect keyboard cable to controller

c Connect ribbon cable

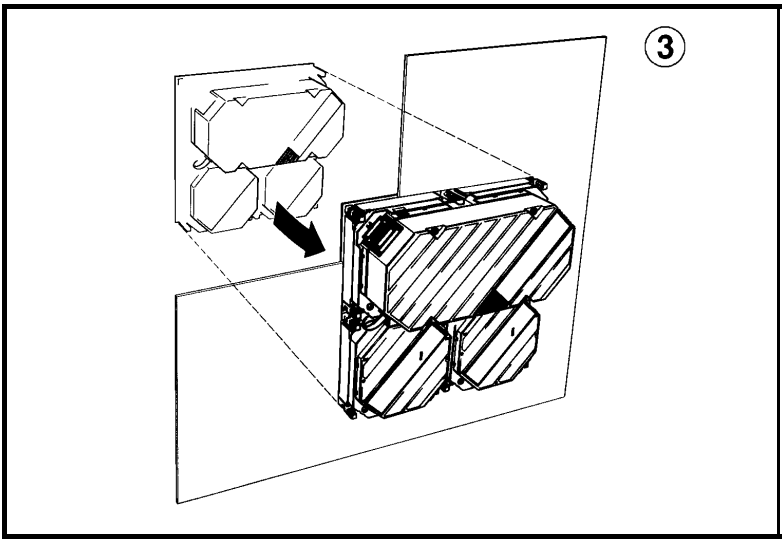
5 Panel Installation



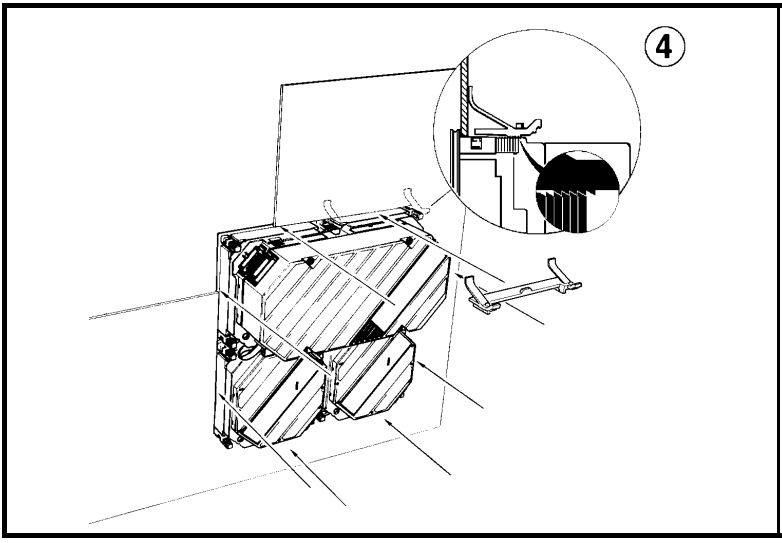
Insert mounting pins



Apply sealant

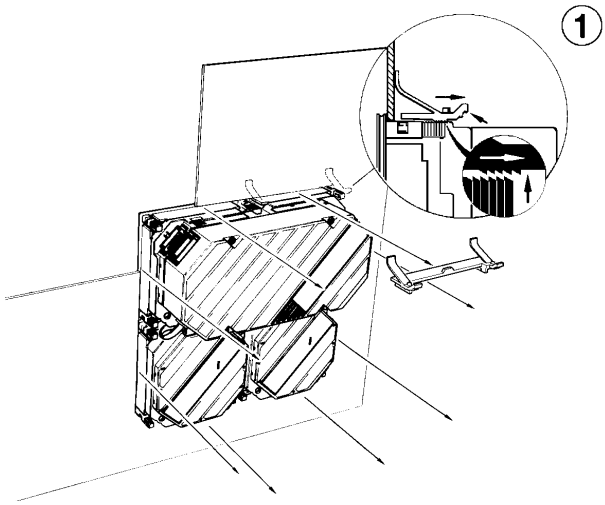


Install panel

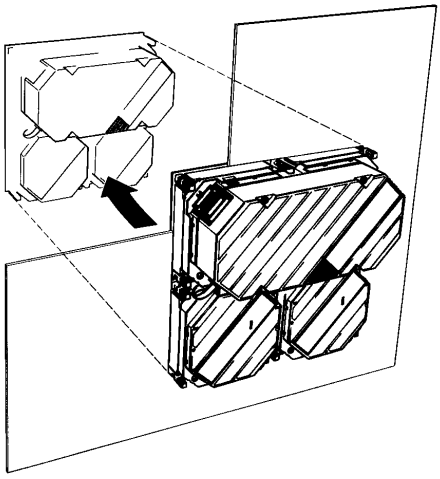


Install spring clips

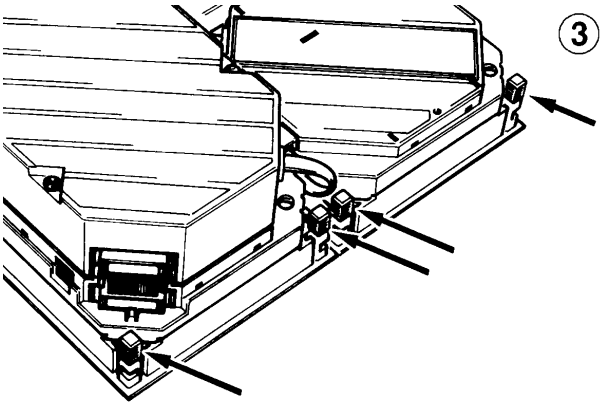
6 Panel Removal



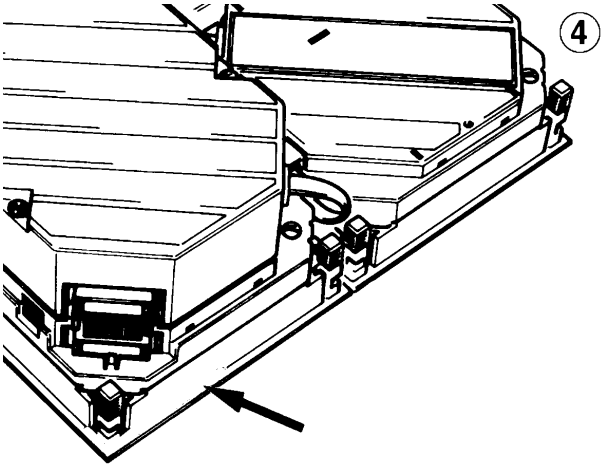
Remove spring clips



Remove panel

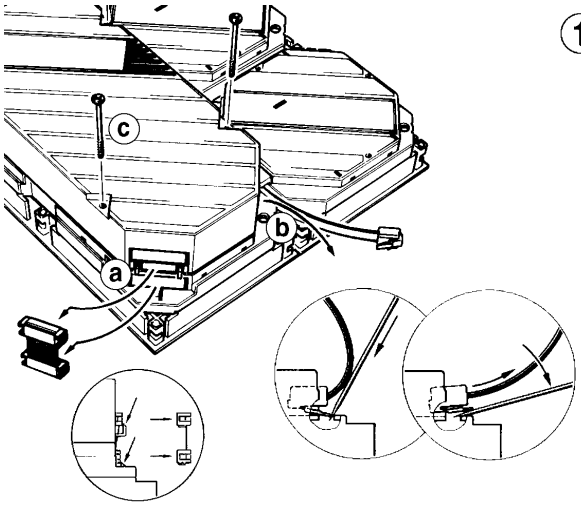


Do not remove mounting clips



Remove remaining sealant before re-installing

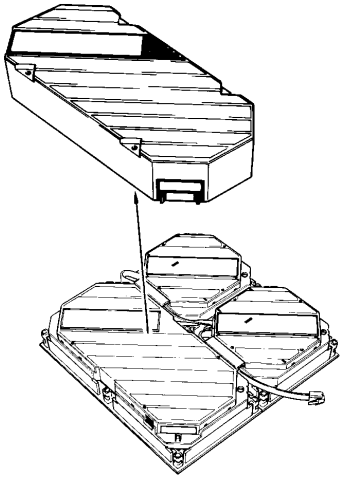
7 Panel Disassembly



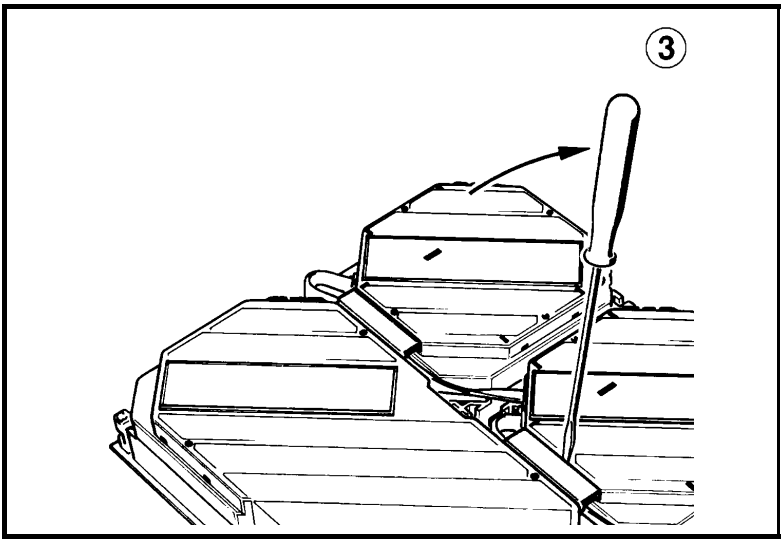
a Disconnect ribbon cable

b Disconnect keyboard cable

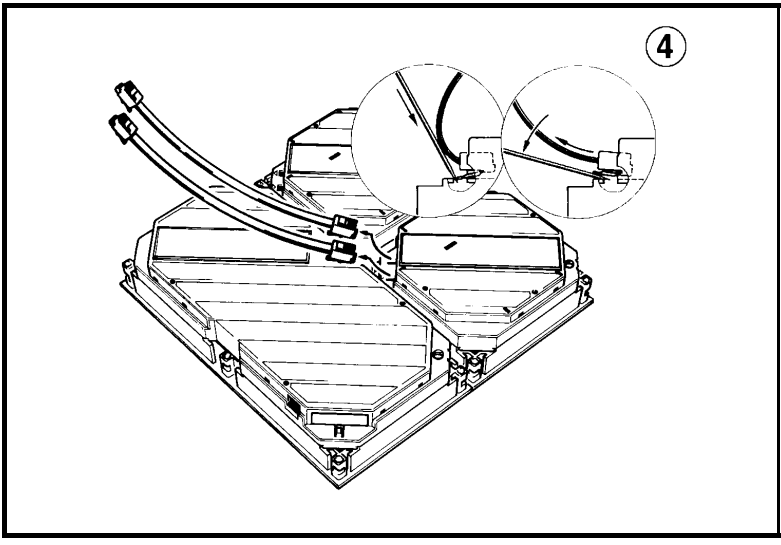
c Remove screws



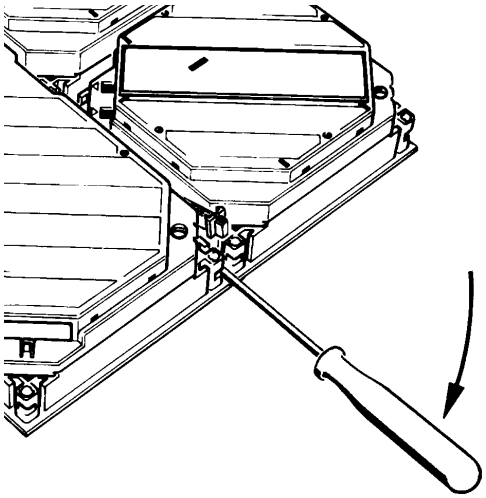
Remove controller



Remove cable covers



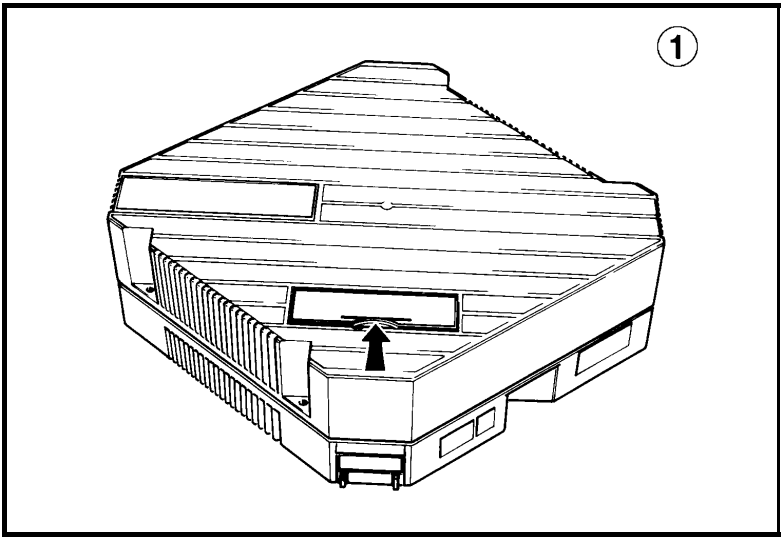
Disconnect and remove keyboard cables



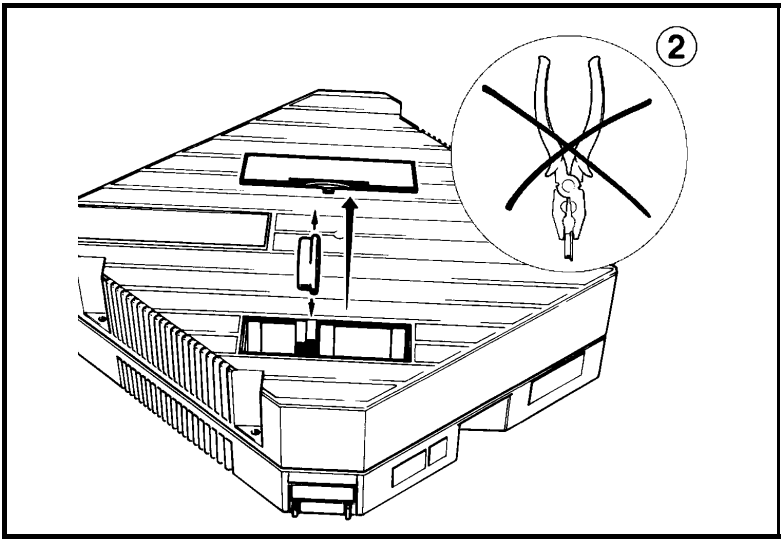
5

Remove module connectors

7 Installing / Replacing the Battery



Remove battery cover



Install / replace battery, do not use conductive tools!

8 Dimensions and Installation

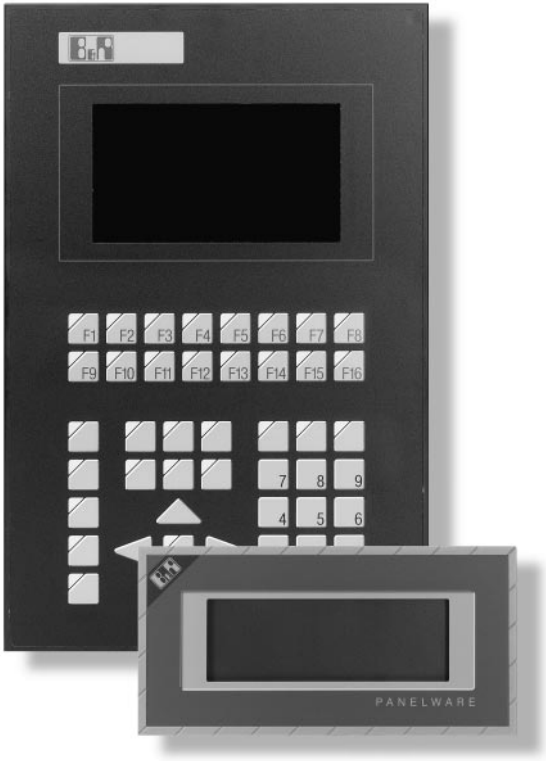
Matrix size	Product Dimensions	Cutout Dimensions [1)]
1	96 mm	92 mm
2	192 mm	188 mm
3	288 mm	284 mm
4	384 mm	380 mm
[1)] Tolerances: -0 mm +0.5 mm		

Example: 3 x 2 Operator panel

l ..... Length = 288 mm
w ... Width = 192 mm
Cutout Dimensions = 284 x 188 mm

Note:
Measurements are generally given in metric units in this manual. However, there are metric to imperial conversion tables provided on the last page of this publication.

CHAPTER 3
DISPLAY MODULES



1 Display Modules

This chapter is a describes the display modules of the PANELWARE operator panels.

- General Information
  - Background Lighting
  - Contrast
  - Connection with the Panel Controller
- Display Modules with LCD Displays
  - Display Module 2 x 20 LCD
  - Display Module 4 x 20 LCD
  - Display Module 4 x 40 LCD
- Display Modules with VFD Displays
  - Display Module 2 x 20 VFD
  - Display Module 2 x 40 VFD
- Graphics Display Modules
  - Graphics Display Module (64 x 240 pixels)
  - Graphics Display Module (128 x 240 pixels)
  - Graphics Display Panel, Horizontal (128 x 240 pixels)
  - Graphics Display Panel, Vertical (128 x 240 pixels)
- Accessories

2 General Information

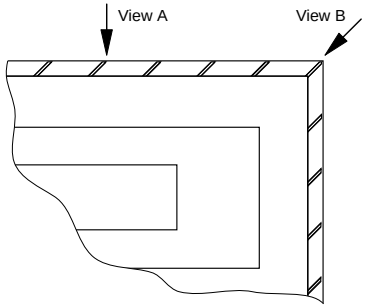
2.1 Background Lighting (only LCD Displays)

All LCD display modules are equipped with background lighting.

Display Module	Background Lighting	Color
Display Module 2 x 20 LCD	LED-Back Lit	Black on yellow
Display Module 2 x 40 LCD	LED-Back Lit	Black on yellow
Display Module 4 x 40 LCD	LED-Back Lit	Black on yellow
Display Module 8 x 40 LCD	CFL-Back Lit	Black on white
Display Module 16 x 40 LCD	CFL-Back Lit	Black on white

2.2 Contrast (only LCD Displays)

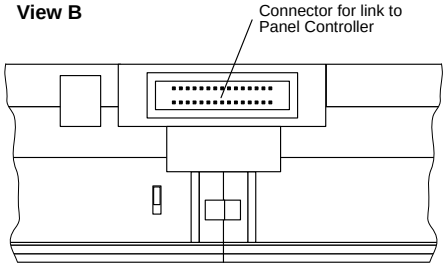
Every LCD display module is equipped with a means of adjusting the contrast. The contrast adjustment is found on the top of the module (see view A).

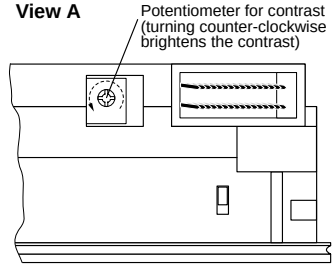


2.3 Connection with the Panel Controller

A connector is found on the top right-hand side for the connection to a panel controller (see view B). This cable is delivered with every display module.

Important: During operation, this is not allowed to be disconnected!

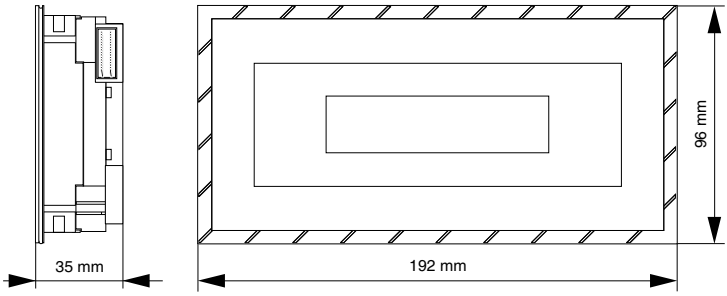




Note: The contrast settings are made differently for 4D1165 and 4D1166 display panels.

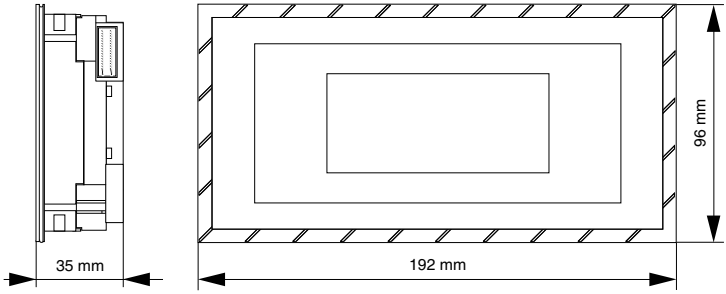
3 Display Modules with LCD Displays

3.1 Display Module 2 x 20 LCD



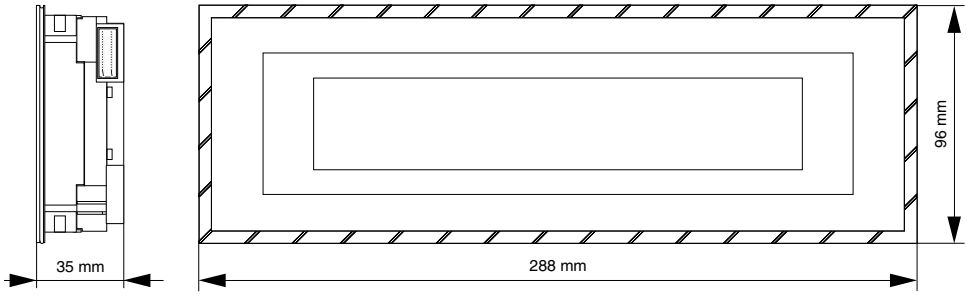
Technical Data	
Model Number	
Blue	4D1022-00-090
Black	4D1022-00-590
Display Type	LCD
Lines x Characters	2 x 20
Character Height	5.0 mm
Background Lighting	LED
Color	Black on yellow
Temperature	
Operating	0 to 50 °C (32 to 122 °F)
Storage	-20 to 60 °C (-4 to 140 °F)
Relative Humidity	
Operating	10 to 90 % (non-condensing)
Storage	10 to 90 % (non-condensing)
Shock	Conforms to IEC 60068-2-27 15g equivalent, 150 m/sec^2, 11 msec, 3 axes (positive and negative)
Vibration	Conforms to IEC 60068-2-6 1g equivalent, 10-58 Hz; 0.075 mm 58-150 Hz; 9.8m/sec^2 20 cycles per axis
Current Requirements	65 mA at 24 VDC

3.2 Display Module 4 x 20 LCD



Technical Data	
Model Number	
Blue	4D1042-00-090
Black	4D1042-00-590
Display Type	LCD
Lines x Characters	4 x 20
Character Height	8.0 mm
Background Lighting	LED
Color	Black on yellow
Temperature	
Operating	0 to 50 °C (32 to 122 °F)
Storage	-20 to 60 °C (-4 to 140 °F)
Relative Humidity	
Operating	10 to 90 % (non-condensing)
Storage	10 to 90 % (non-condensing)
Shock	Conforms to IEC 68-2-27 15g equivalent, 150 m/sec 11 msec, 3 axes (positive and negative)
Vibration	Conforms to IEC 68-2-6 1g equivalent, 10-58 Hz; 0.075 mm 58-150 Hz; 9.8m/sec^2 20 cycles per axis
Current Requirements	180 mA at 24 VDC

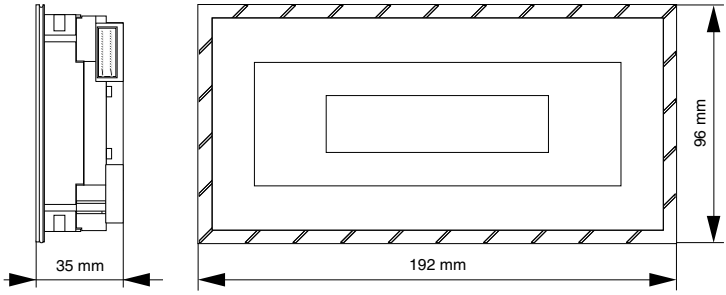
3.3 Display Module 4 x 40 LCD



Technical Data	
Model Number	
Blue	4D1044-00-090
Black	4D1044-00-590
Display Type	LCD
Lines x Characters	4 x 40
Character Height	4.3 mm
Background Lighting	LED
Color	Black on yellow
Temperature	
Operating	0 to 50 °C (32 to 122 °F)
Storage	-20 to 60 °C (-4 to 140 °F)
Relative Humidity	
Operating	10 to 90 % (non-condensing)
Storage	10 to 90 % (non-condensing)
Shock	Conforms to IEC 60068-2-27 15g equivalent, 150 m/sec^2, 11 msec, 3 axes (positive and negative)
Vibration	Conforms to IEC 60068-2-6 1g equivalent, 10-58 Hz; 0.075 mm 58-150 Hz; 9.8m/sec^2 20 cycles per axis
Current Requirements	155 mA at 24 VDC

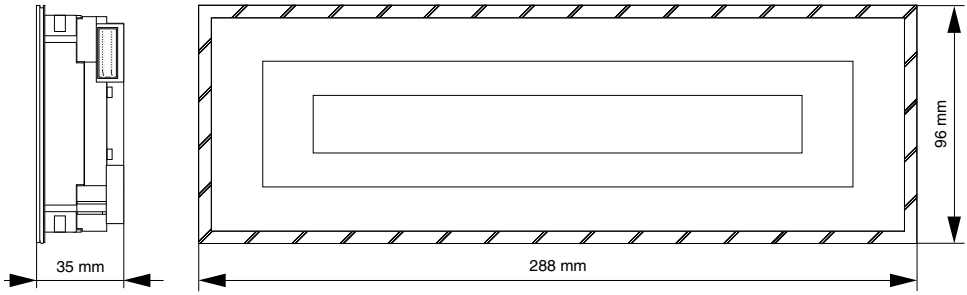
4 Display Modules with VFD Displays

4.1 Display Module 2 x 20 VFD



Technical Data	
Model Number	
Blue	4D2022-00-090
Black	4D2022-00-590
Display Type	VFD
Lines x Characters	2 x 20
Character Height	5.0 mm
Background Lighting	None
Color	Green (505 nm)
Temperature	
Operating	0 to 50 °C (32 to 122 °F)
Storage	-20 to 60 °C (-4 to 140 °F)
Relative Humidity	
Operating	20 to 85 % (non-condensing)
Storage	20 to 90 % (non-condensing)
Shock	Conforms to IEC 60068-2-27 15g equivalent, 150 m/sec^2, 11 msec, 3 axes (positive and negative)
Vibration	Conforms to IEC 60068-2-6 1g equivalent, 10-58 Hz; 0.075 mm 58-150 Hz; 9.8m/sec^2 20 cycles per axis
Current Requirements	90 mA at 24 VDC (additional 25 mA with full screen of information)

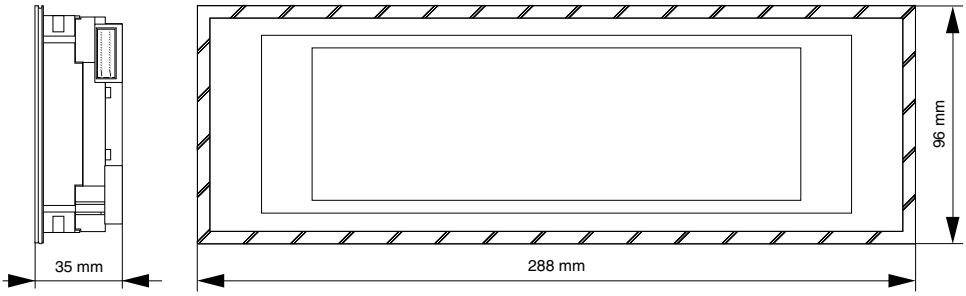
4.2 Display Module 2 x 40 VFD



Technical Data	
Model Number	
Blue	4D2024-00-090
Black	4D2024-00-590
Display Type	VFD
Lines x Characters	2 x 40
Character Height	5.0 mm
Background Lighting	None
Color	Green (505 nm)
Temperature	
Operating	0 to 50 °C (32 to 122 °F)
Storage	-20 to 60 °C (-4 to 140 °F)
Relative Humidity	
Operating	20 to 85 % (non-condensing)
Storage	20 to 90 % (non-condensing)
Shock	Conforms to IEC 60068-2-27 15g equivalent, 150 m/sec^2, 11 msec, 3 axes (positive and negative)
Vibration	Conforms to IEC 60068-2-6 1g equivalent, 10-58 Hz; 0.075 mm 58-150 Hz; 9.8m/sec^2 20 cycles per axis
Current Requirements	130 mA at 24 VDC (additional 25 mA with full screen of information)

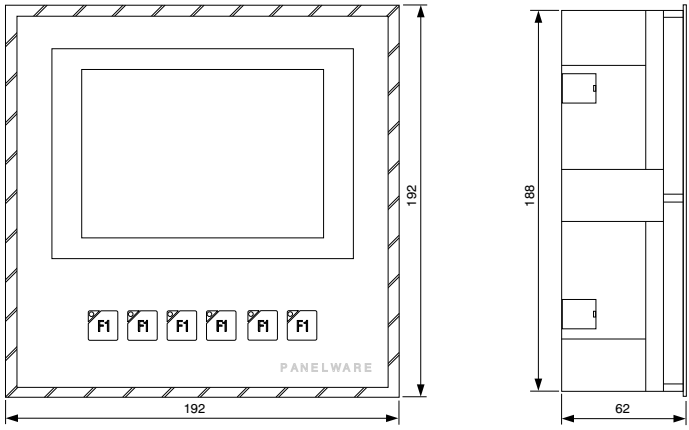
4 Graphic Display Modules

4.1 Graphic Display 64 x 240 Pixels



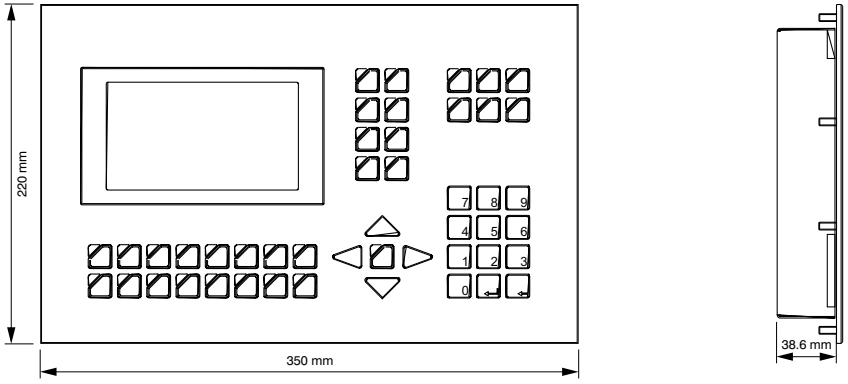
Technical Data	
Model Number	
Blue	4D1084-00-090
Black	4D1084-00-590
Display Type	LCD, graphics capable
Resolution	
Text Mode	8 lines x 40 characters
Graphics Mode	64 x 240 pixels
Background Lighting	CFL (miniature fluorescent lamp)
Temperature	
Operating	0 to 50 °C (32 to 122 °F)
Storage	-20 to 60 °C (-4 to 140 °F)
Relative Humidity	
Operating	20 to 85 % (non-condensing)
Storage	20 to 90 % (non-condensing)
Shock	Conforms to IEC 60068-2-27 15g equivalent, 150 m/sec^2, 11 msec, 3 axes (positive and negative)
Vibration	Conforms to IEC 60068-2-6 1g equivalent, 10-58 Hz; 0.075 mm 58-150 Hz; 9.8m/sec^2 20 cycles per axis
Current Requirements	160 mA at 24 VDC

4.2 Graphic Display 128 x 240 Pixels



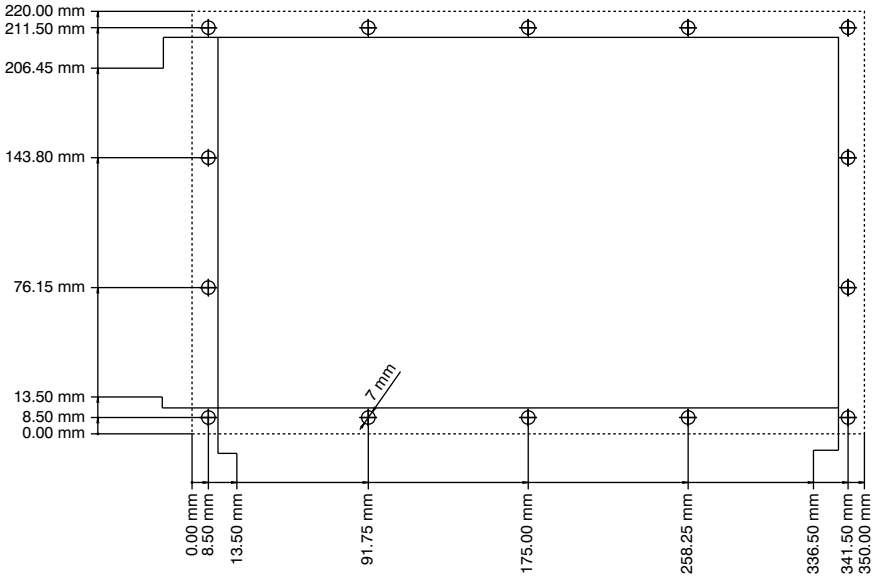
Technical Data	
Model Number	
Blue	4D1164-00-090
Black	4D1164-00-590
Display Type	LCD, graphics capable
Resolution	
Text Mode	16 lines x 40 characters
Graphics Mode	128 x 240 pixels
Background Lighting	CFL (miniature fluorescent lamp)
Keys	6 keys with LEDs
Temperature	
Operating	0 to 50 °C (32 to 122 °F)
Storage	-20 to 60 °C (-4 to 140 °F)
Relative Humidity	
Operating	20 to 85 % (non-condensing)
Storage	20 to 90 % (non-condensing)
Shock	Conforms to IEC 60068-2-27 15g equivalent, 150 m/sec^2, 11 msec, 3 axes (positive and negative)
Vibration	Conforms to IEC 60068-2-6 1g equivalent, 10-58 Hz; 0.075 mm 58-150 Hz; 9.8m/sec^2 20 cycles per axis
Current Requirements	135 mA at 24 VDC

4.3 Graphic Display Panel 128 x 240 Pixels, Horitontal

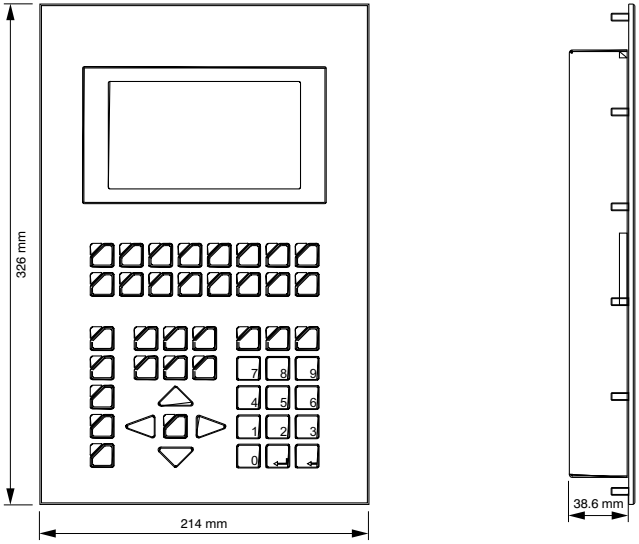


Technical Data	
Model Number	4D1165-00-590
Display Type	LCD, graphics capable
Resolution	
Text Mode	16 lines x 40 characters
Graphics Mode	128 x 240 pixels
Background Lighting	CFL (miniature fluorescent lamp)
Front	IP65 Aluminum, horizontal
Keys	
Function Keys	16 keys with LEDs
Number Block	12 key block
User Keys	14 keys with LEDs
Cursor Keys	5 keys
Temperature	
Operating	0 to 50 °C (32 to 122 °F)
Storage	-20 to 60 °C (-4 to 140 °F)
Relative Humidity	
Operating	20 to 85 % (non-condensing)
Storage	20 to 90 % (non-condensing)
Shock	Conforms to IEC 60068-2-27 15g equivalent, 150 m/sec^2, 11 msec, 3 axes (positive and negative)
Vibration	Conforms to IEC 60068-2-6 1g equivalent, 10-58 Hz; 0.075 mm 58-150 Hz; 9.8m/sec^2 20 cycles per axis
Current Requirements	150 mA at 24 VDC

4.3.1 Cutout and Drill-Hole Dimensions



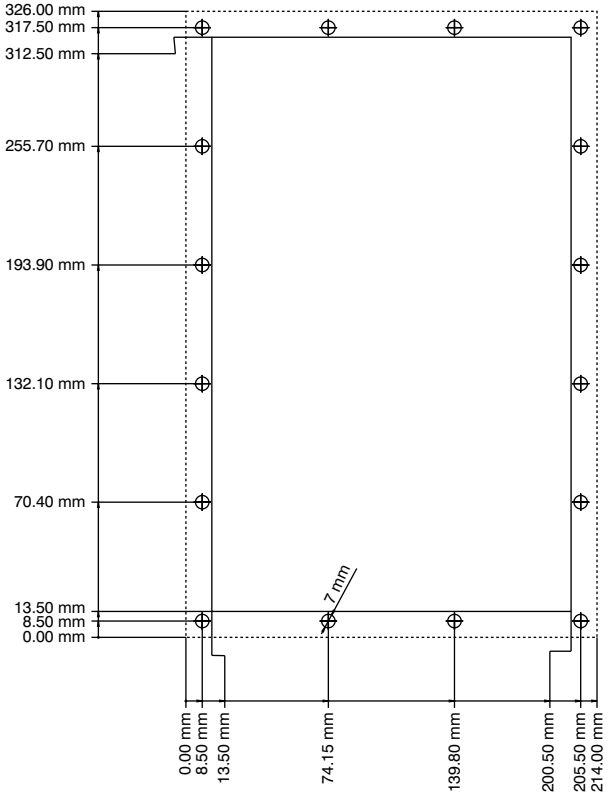
4.4 Graphic Display Panel 128 x 240 Pixels, Vertical



Technical Data	
Model Number	4D1166-00-590
Display Type	LCD, graphics capable
Resolution	
Text Mode	16 lines x 40 characters
Graphics Mode	128 x 240 pixels
Background Lighting	CFL (miniature fluorescent lamp)
Front	IP65 Aluminum, vertical
Keys	
Function Keys	16 keys with LEDs
Number Block	12 key block
User Keys	14 keys with LEDs
Cursor Keys	5 keys
Temperature	
Operating	0 to 50 °C (32 to 122 °F)
Storage	-20 to 60 °C (-4 to 140 °F)
Relative Humidity	
Operating	20 to 85 % (non-condensing)
Storage	20 to 90 % (non-condensing)

Technical Data (cont.)	
Shock	Conforms to IEC 60068-2-27 15g equivalent, 150 m/sec^2, 11 msec, 3 axes (positive and negative)
Vibration	Conforms to IEC 60068-2-6 1g equivalent, 10-58 Hz; 0.075 mm 58-150 Hz; 9.8m/sec^2 20 cycles per axis
Current Requirements	150 mA at 24 VDC

4.4.1 Cutout and Drill-Hole Dimensions



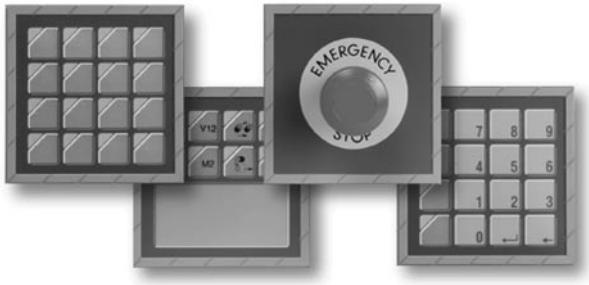
5 Display Module Accessories

Accessory components are required for each display module. These are included in the same package as the display module and sent with the delivery.

Accessory components	Amount	
	2 x 1 Display	3 x 1 Display
Ribbon cable (between the display module and the panel controller)	1	1
Spring Clips	6	8
Mounting pins	1	1

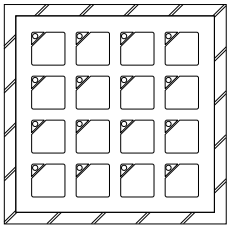
Label strips are provided for 4D1165 and 4D166 display panels. Additional label strips can be ordered from B&R (see "Accessories").

CHAPTER 4
KEYPAD MODULES



1 PANELWARE Keypad Module Overview

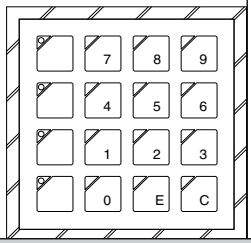
16 Keys



Keys: 16

LEDs: 16

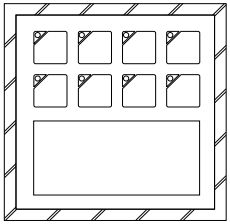
12 + 4 Keys



Keys: 16

LEDs: 4

8 Keys

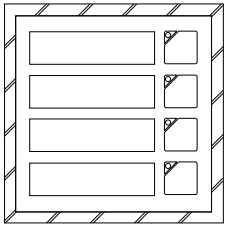


Keys: 8

LEDs: 8

Label Fields: 1

4 Keys

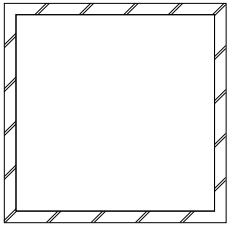


Keys: 4

LEDs: 4

Label Fields: 4

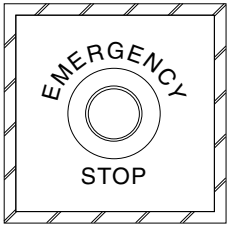
Dummy Module



Keys: none

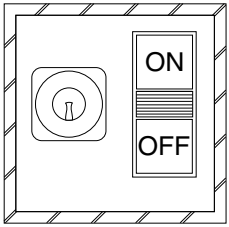
LEDs: none

E-STOP



E-STOP Button

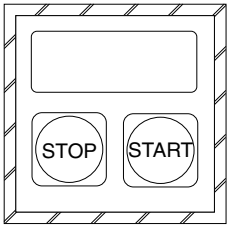
Key Switch



Key Switch: 1

On/Off Switch: 1

Start / Stop



Keys: 2

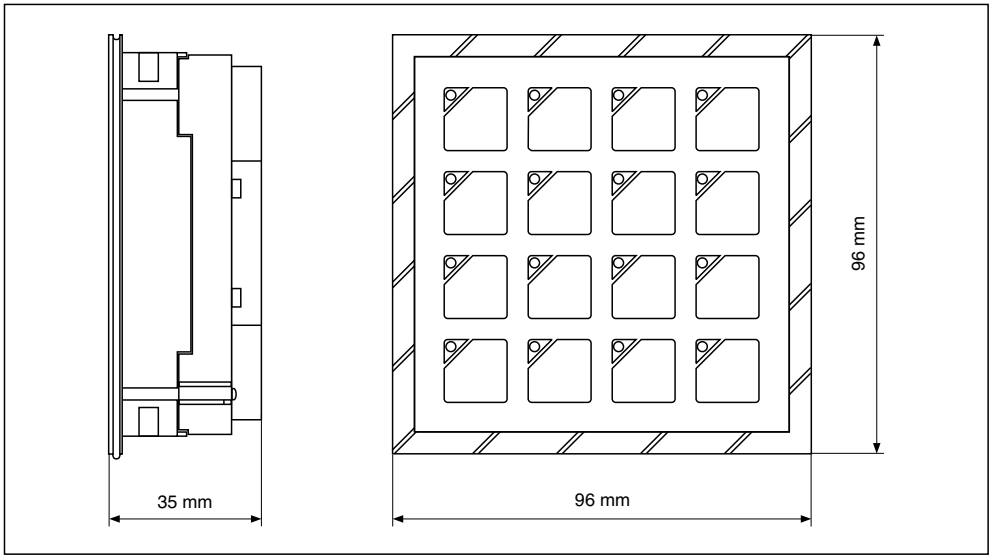
Label Fields: 1

2 General Information

2.1 Measurements

All standard keypad modules have the same measurements. Special keypad modules are up to 60 mm deep.

For the most part, measurements are given as metric values in this manual. There are metric to imperial conversion tables provided on the last page of this publication.



2.2 Standard or Special Keypad Modules

The keypad modules are divided into two groups:

- **Standard Keypad Modules** can be daisy chained and connected to a controller. 7 keypad modules can be connected.

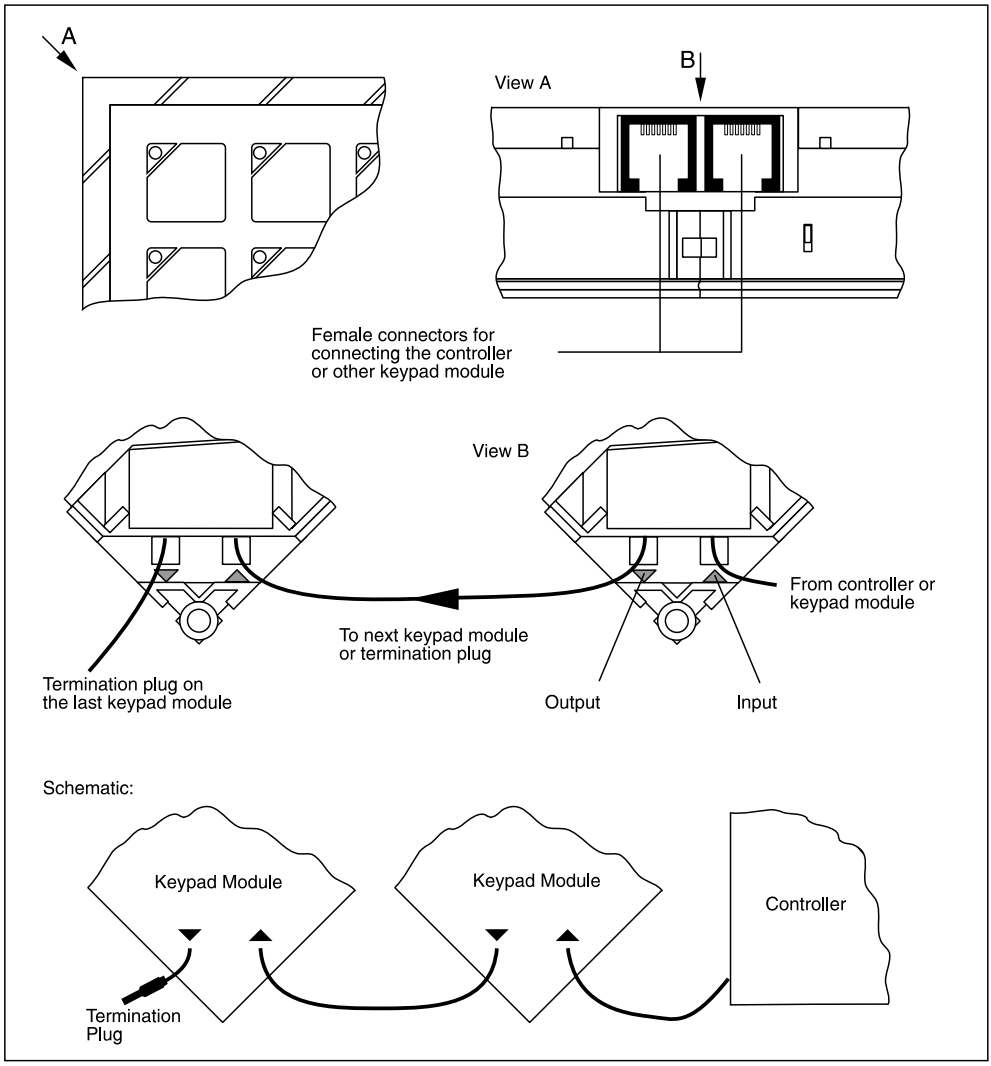
- **Special Keypad Modules** are identical to the rest of the keypad modules regarding their design. An electrical connection with a controller or standard keypad module is not possible. They are to be wired by an electrician according to their function (e.g. connecting an E-STOP button to an emergency stop circuit).

3 Standard Keypad Modules

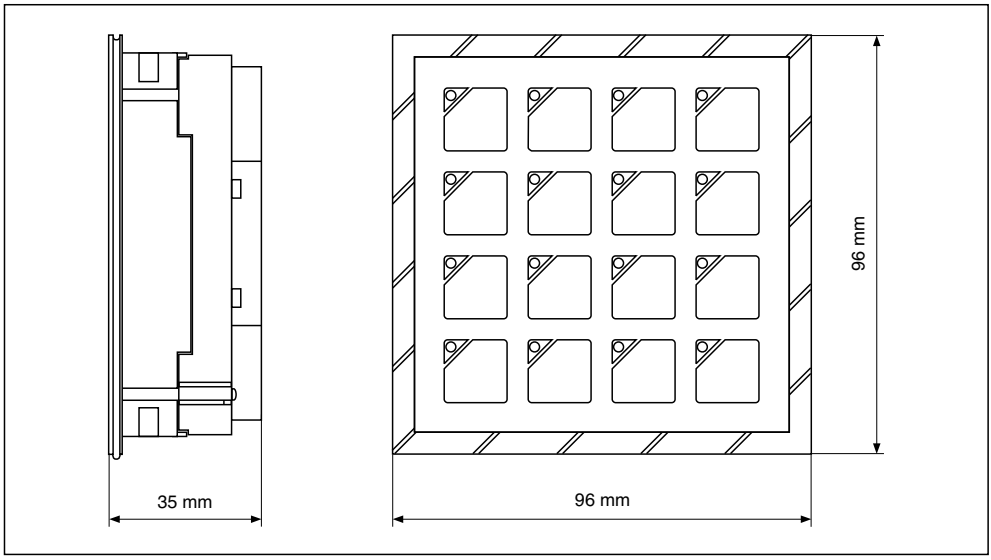
3.1 Connecting to a Controller or Other Keypad Modules

All standard keypad modules can be connected to a controller or another keypad module with a connection cable. There are two female connectors provided on the modules for this purpose. The connectors are labeled as input or output with triangle arrows!

Make sure that an input is never connected to an input or an output is never connected to an output since this will damage the modules!

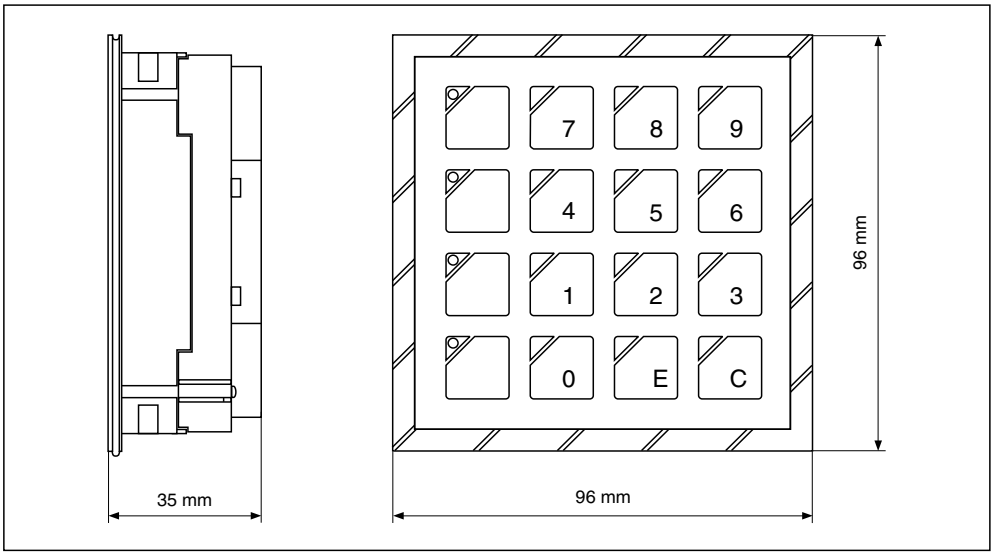


3.2 Keypad Module 16 Keys



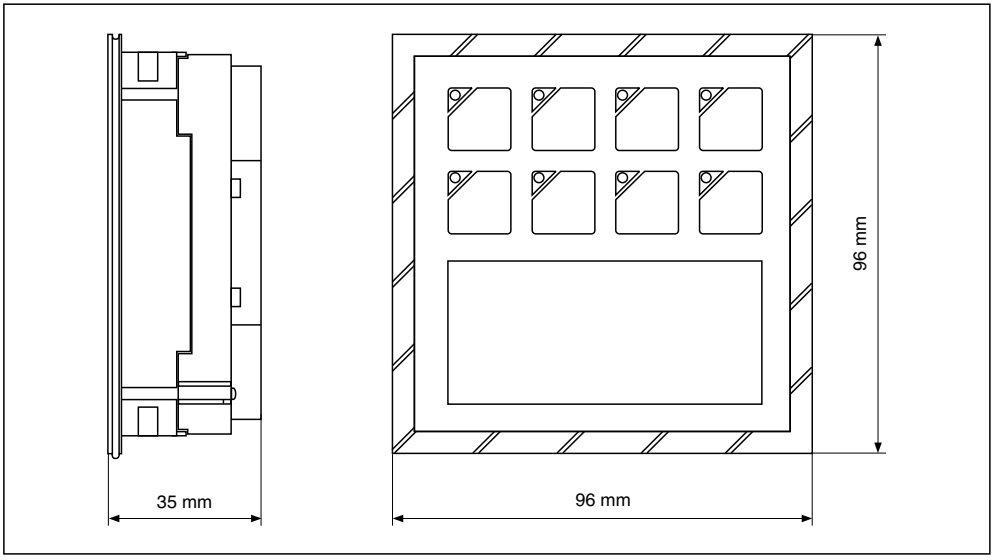
Technical Data	
Model Number	4E0011.01-090
Number of Keys	16 short stroke keys
Number of LEDs	16 (yellow)
Labeling	Can be labeled by the user
Temperature Range **Operating** **Storage**	 0 to 50 °C (32 to 122 °F) -20 to 60 °C (-4 to 140 °F)
Relative Humidity **Operating** **Storage**	 5 to 95 % (non-condensing) 5 to 95 % (non-condensing)
Shock	Conforms to IEC 60068-2-27 15g equivalent, 150 m/sec^2, 11 msec, 3 axes (positive and negative)
Vibration	Conforms to IEC 60068-2-6 1g equivalent, 10-58 Hz; 0.075 mm 58-150 Hz; 9.8m/sec^2 20 cycles per axis
Current Requirements	1.5 mA at 24 VDC (each LED requires an additional 3 mA when lit)

3.3 Keypad Module 12+4 Keys



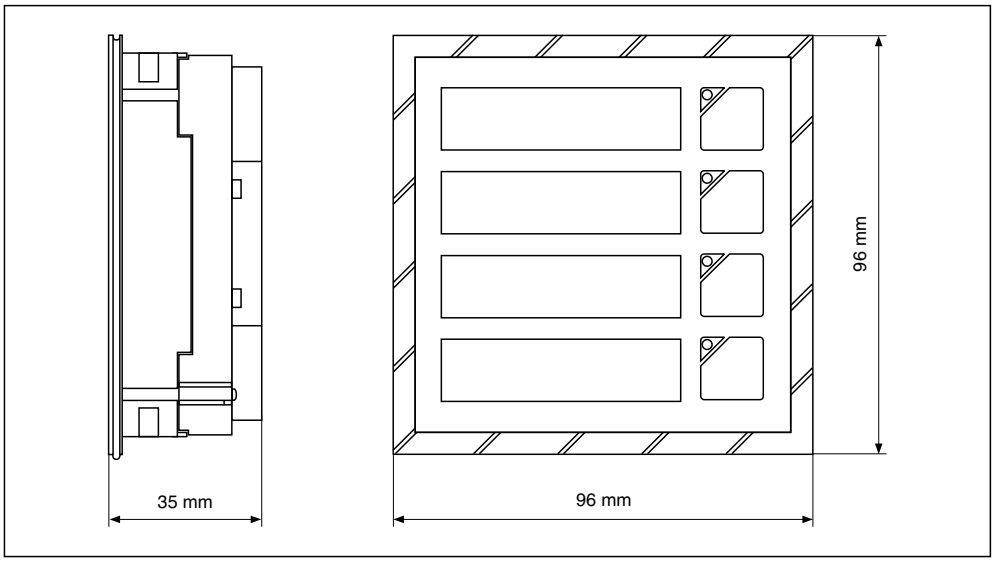
Technical Data	
Model Number	4E0021.01-090
Number of Keys	16 short stroke keys
Number of LEDs	4 (yellow)
Labeling	12 keys are labeled as a number block 4 keys can be labeled by the user
Temperature Range **Operating** **Storage**	 0 to 50 °C (32 to 122 °F) -20 to 60 °C (-4 to 140 °F)
Relative Humidity **Operating** **Storage**	 5 to 95 % (non-condensing) 5 to 95 % (non-condensing)
Shock	Conforms to IEC 60068-2-27 15g equivalent, 150 m/sec^2, 11 msec, 3 axes (positive and negative)
Vibration	Conforms to IEC 60068-2-6 1g equivalent, 10-58 Hz; 0.075 mm 58-150 Hz; 9.8m/sec^2 20 cycles per axis
Current Requirements	1.5 mA at 24 VDC (each LED requires an additional 3 mA when lit)

3.4 Keypad Module 8 Keys



Technical Data	
Model Number	4E0031.01-090
Number of Keys	8 short stroke keys
Number of LEDs	8 (yellow)
Labeling	Can be labeled by the user
Label Fields	A field for additional information
Temperature Range **Operating** **Storage**	 0 to 50 °C (32 to 122 °F) -20 to 60 °C (-4 to 140 °F)
Relative Humidity **Operating** **Storage**	 5 to 95 % (non-condensing) 5 to 95 % (non-condensing)
Shock	Conforms to IEC 60068-2-27 15g equivalent, 150 m/sec^2, 11 msec, 3 axes (positive and negative)
Vibration	Conforms to IEC 60068-2-6 1g equivalent, 10-58 Hz; 0.075 mm 58-150 Hz; 9.8m/sec^2 20 cycles per axis
Current Requirements	1.5 mA at 24 VDC (each LED requires an additional 3 mA when lit)

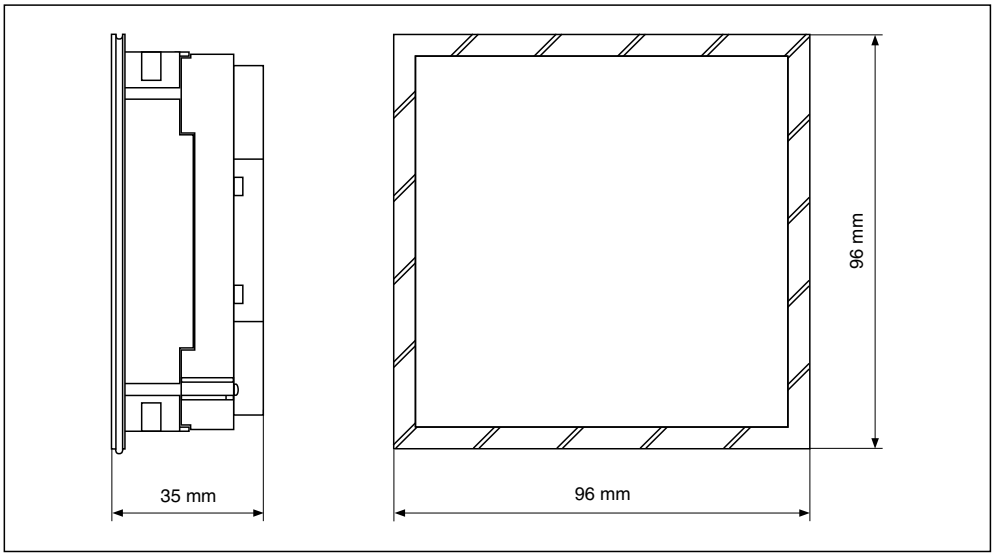
3.5 Keypad Module 4 Keys



Technical Data	
Model Number	4E0041.01-090
Number of Keys	4 short stroke keys
Number of LEDs	4 (yellow)
Labeling	Can be labeled by the user
Label Fields	4 fields for additional information
Temperature Range **Operating** **Storage**	 0 to 50 °C (32 to 122 °F) -20 to 60 °C (-4 to 140 °F)
Relative Humidity **Operating** **Storage**	 5 to 95 % (non-condensing) 5 to 95 % (non-condensing)
Shock	Conforms to IEC 60068-2-27 15g equivalent, 150 m/sec^2, 11 msec, 3 axes (positive and negative)
Vibration	Conforms to IEC 60068-2-6 1g equivalent, 10-58 Hz; 0.075 mm 58-150 Hz; 9.8m/sec^2 20 cycles per axis
Current Requirements	1.5 mA at 24 VDC (each LED requires an additional 3 mA when lit)

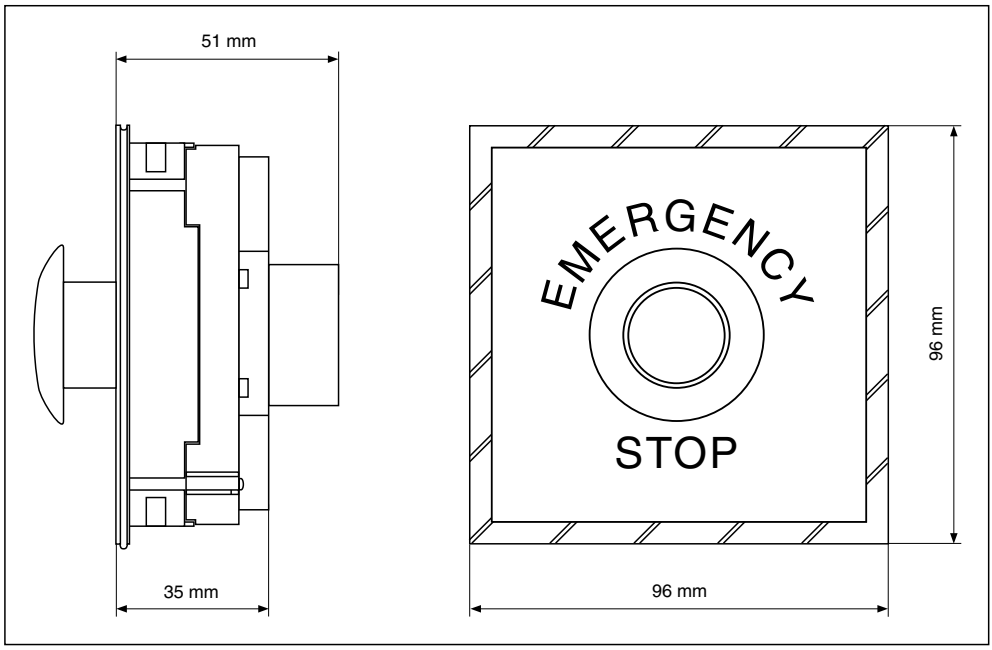
4 Special Keypad Modules

4.1 Dummy Module



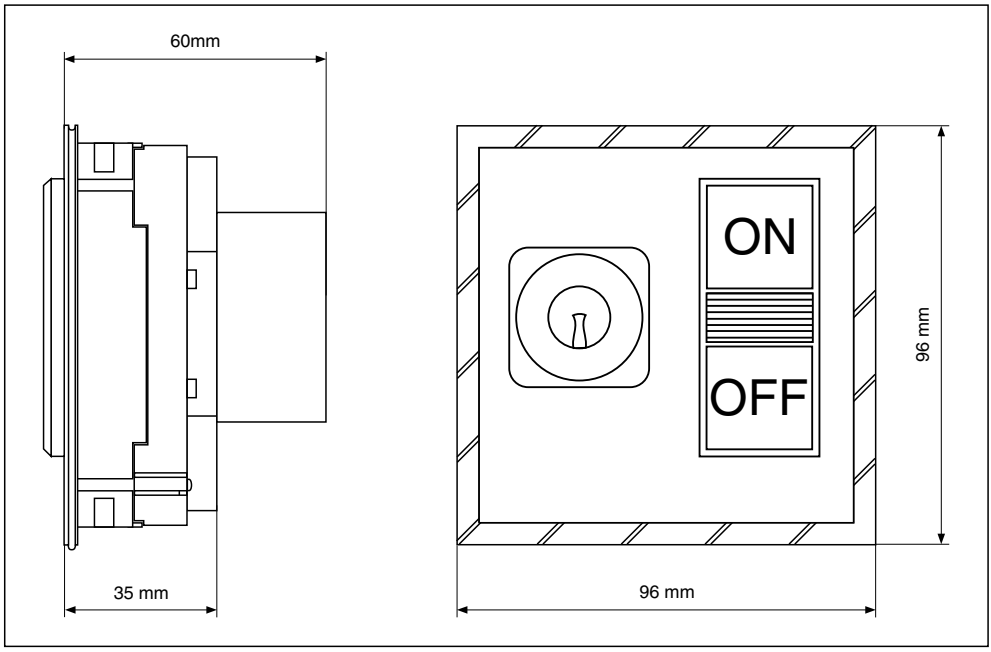
Technical Data	
Model Number	4E0050.01-090
Number of Keys	none
Number of LEDs	none
Temperature Range **Operating** **Storage**	 0 to 50 °C (32 to 122 °F) -20 to 60 °C (-4 to 140 °F)
Relative Humidity **Operating** **Storage**	 5 to 95 % (non-condensing) 5 to 95 % (non-condensing)
Shock	Conforms to IEC 60068-2-27 15g equivalent, 150 m/sec^2, 11 msec, 3 axes (positive and negative)
Vibration	Conforms to IEC 60068-2-6 1g equivalent, 10-58 Hz; 0.075 mm 58-150 Hz; 9.8m/sec^2 20 cycles per axis

4.2 E-STOP Button



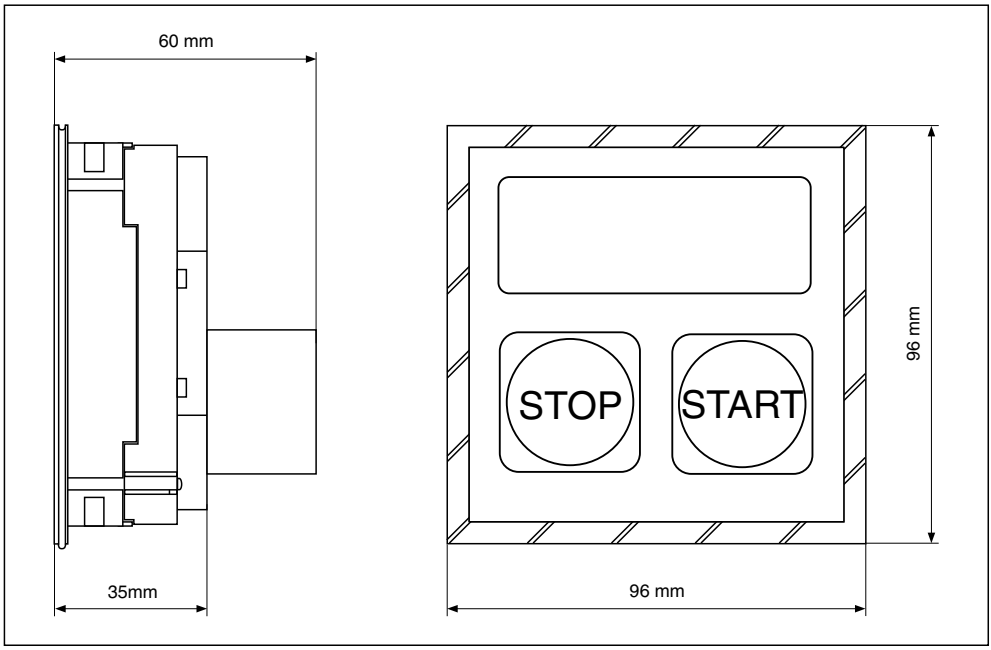
Technical Data	
Model Number	4E0060.01-090
Number of Keys	1 E-Stop Button
Temperature Range **Operating** **Storage**	 0 to 50 °C (32 to 122 °F) -20 to 60 °C (-4 to 140 °F)
Relative Humidity **Operating** **Storage**	 5 to 95 % (non-condensing) 5 to 95 % (non-condensing)
Shock	Conforms to IEC 60068-2-27 15g equivalent, 150 m/sec^2, 11 msec, 3 axes (positive and negative)
Vibration	Conforms to IEC 60068-2-6 1g equivalent, 10-58 Hz; 0.075 mm 58-150 Hz; 9.8m/sec^2 20 cycles per axis

4.3 Key Switch



Technical Data	
Model Number	4E0070.01-090
Number of Keys	1 key switch 1 ON/OFF switch
Temperature Range **Operating** **Storage**	 0 to 50 °C (32 to 122 °F) -20 to 60 °C (-4 to 140 °F)
Relative Humidity **Operating** **Storage**	 5 to 95 % (non-condensing) 5 to 95 % (non-condensing)
Shock	Conforms to IEC 60068-2-27 15g equivalent, 150 m/sec^2, 11 msec, 3 axes (positive and negative)
Vibration	Conforms to IEC 60068-2-6 1g equivalent, 10-58 Hz; 0.075 mm 58-150 Hz; 9.8m/sec^2 20 cycles per axis

4.4 Start/Stop



Technical Data	
Model Number	4E0080.01-090
Number of Keys	2 buttons (labeled START and STOP)
Temperature Range **Operating** **Storage**	 0 to 50 °C (32 to 122 °F) -20 to 60 °C (-4 to 140 °F)
Relative Humidity **Operating** **Storage**	 5 to 95 % (non-condensing) 5 to 95 % (non-condensing)
Shock	Conforms to IEC 60068-2-27 15g equivalent, 150 m/sec^2, 11 msec, 3 axes (positive and negative)
Vibration	Conforms to IEC 60068-2-6 1g equivalent, 10-58 Hz; 0.075 mm 58-150 Hz; 9.8m/sec^2 20 cycles per axis

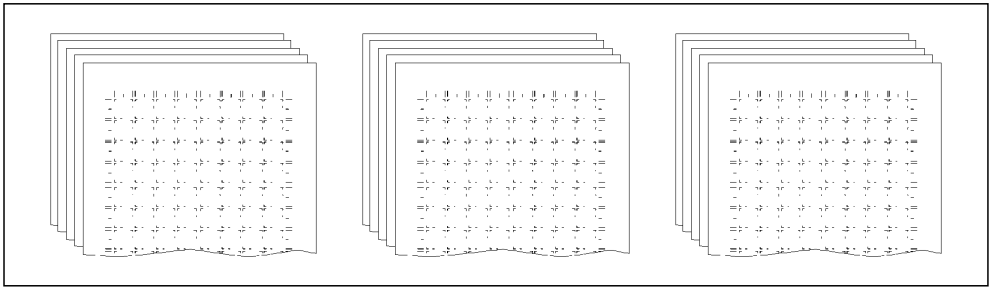
5 Keypad Module Accessories

Accessories which are delivered with each keypad module. They are packaged together with the module.

Accessories	Amount	
	Standard Keypad Module	Special Keypad Module
Connection Elements	2	2
Cable Covers	2	2
Keypad Module Cable (connection to a controller or keypad module)	1	--
Clamps	2	2
Mounting Bolt Pins	1	1

Accessories which are not delivered with each keypad module.

A4/LS Legend Sheets 4A0005.00-000



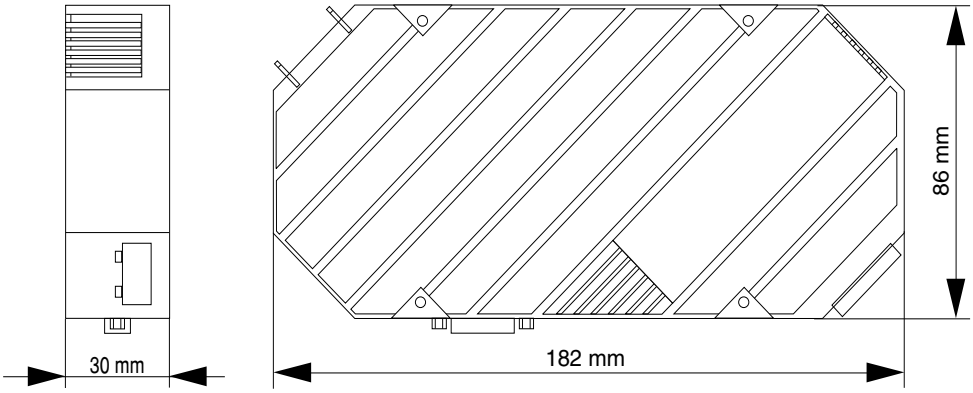
Five label sheets each for keypad modules with 4, 8, and 16 LEDs in A4 and US Letter format. Each label sheet has six keypad labels. The keypad labels are perforated so they can be removed from the label sheet easily.

CHAPTER 5
PANEL CONTROLLERS

1 Panel Controllers

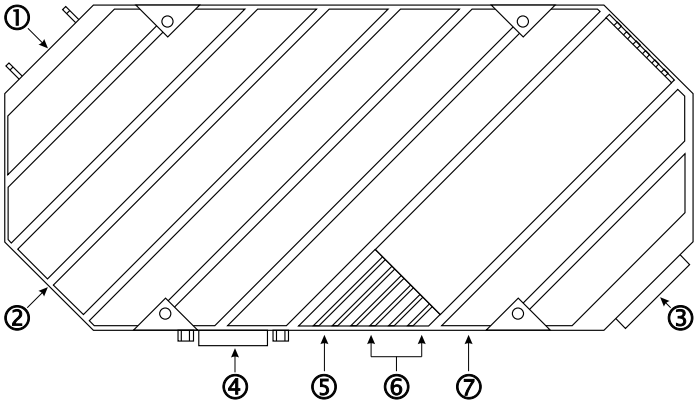
- Panel Controller C100
- Panel Slave Controller C110
- Panel Slave Controller C130
- Panel Controller C200
- Panel Controller C220 / C221
- Panel Controller C300
- General Information about C2xx / C300
- Accessories

2 Panel Controller C100



Technical Data	
Interface	RS232 (not electrically isolated)
Control	VT100 Command Set
Supply	24 VDC (min. 18 VDC, max. 30 VDC)
Connection of	
Display Modules	1
Keypad Modules	max. 7
Temperature	
Operating	0 to 50 °C (32 to 122 °F)
Storage	-20 to 60 °C (-4 to 140 °F)
Relative Humidity	
Operating	10 to 95 % (non-condensing)
Storage	10 to 95 % (non-condensing)
Shock	Conforms to IEC 60068-2-27 15g equivalent, 150 m/sec^2, 11 msec, 3 axes (positive and negative)
Vibration	Conforms to IEC 60068-2-6 1g equivalent, 10-58 Hz; 0.075 mm 58-150 Hz; 9.8m/sec^2 20 Cycles per axis
Current Requirements	65 mA at 24 VDC

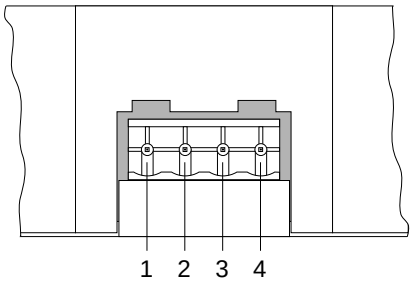
2.1 Overview of Connections and Operational Elements



1 Display Module Connector
2 Keypad Module Connector
3 24 V Supply Voltage Connector
4 RS232 interface, 9 pin D-Type (M)
for connection to a PC (PCS) or a PLC

5 - 7 Number Switch
5 Operating Mode
6 Parity / Handshake
7 Baudrate

2.1.1 Supply Voltage (24 VDC)



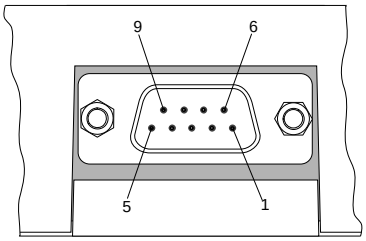
Pin		Description
1	+	+24 VDC
2	-	GND
3		Ground
4		Ground

All components must be properly grounded. (If in a rack, the ground cable length must not exceed 15 cm.). This is particularly important for the reasons listed below.

- A low resistance path from all parts of a system to earth minimizes exposure to shock in the event of short circuits or equipment malfunction.
- PANELWARE operator panels require proper grounding for correct operation.

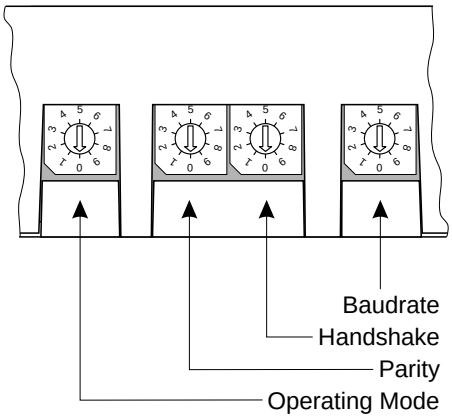
The importance of a properly grounded system cannot be over emphasized.

2.1.2 RS232 Interface



Pin	Description	
1	NC	
2	RxD	Receive Data
3	TxD	Transmit Data
4	5 V	Power supply (max. 150 mA)
5	GND	
6	NC	
7	RTS	Request To Send
8	CTS	Clear To Send
9	NC	

2.1.3 Number Dials



Parity

Switch setting	Parity
0	None
1	Odd
2	Even
3 - 9	Not allowed

Handshake

Switch setting	Handshake
0	No handshake
1	XON/XOFF operation
2	Hardware handshake
3 - 9	Not allowed

Note:
In handshake modes 0 and 1, the RTS and CTS lines must be connnected together on the C100 RS232 interface.

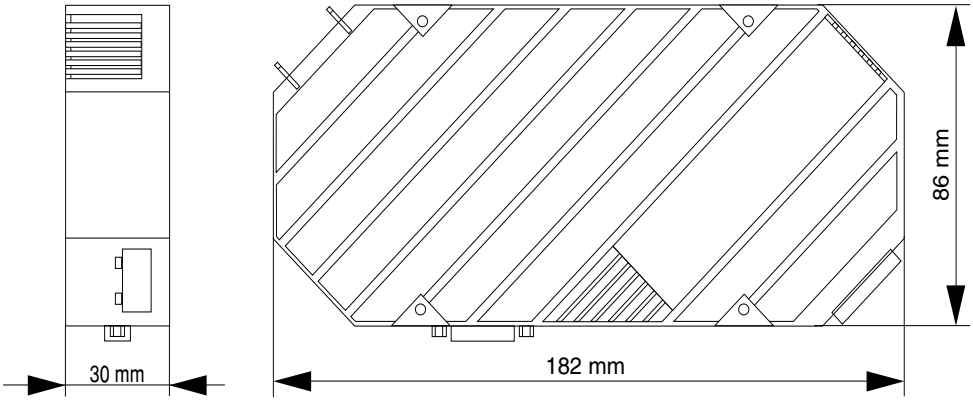
Operating Mode

Switch setting	Parity
0	VT100 emulation
1	Reserved
2 - 9	Not allowed

Baudrate

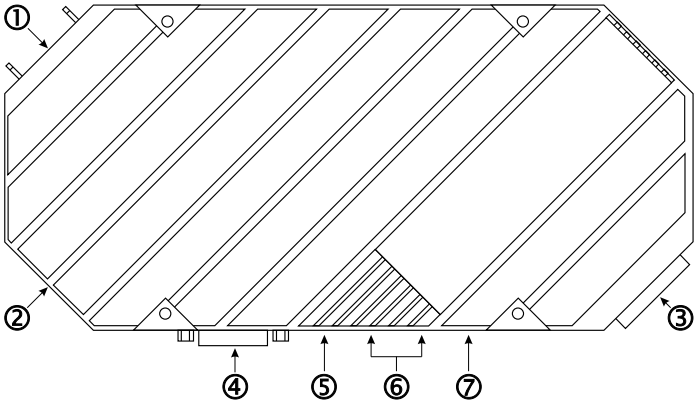
Switch setting	Baudrate
0	300
1	1200
2	4800
3	9600
4	19200
5	38400 (only in XON/XOFF operation)

3 Panel Slave Controller C110



Technical Data	
Interface	RS422, RS485 (network capable)
Control	Panel Controller C300 (PANELWARE software)
Supply	24 VDC (min. 18 VDC, max. 30 VDC)
Connection of	
Display Modules	1
Keypad Modules	max. 7
Temperature	
Operating	0 to 50 °C (32 to 122 °F)
Storage	-20 to 60 °C (-4 to 140 °F)
Relative Humidity	
Operating	10 to 95 % (non-condensing)
Storage	10 to 95 % (non-condensing)
Shock	Conforms to IEC 60068-2-27 15g equivalent, 150 m/sec^2, 11 msec, 3 axes (positive and negative)
Vibration	Conforms to IEC 60068-2-6 1g equivalent, 10-58 Hz; 0.075 mm 58-150 Hz; 9.8m/sec^2 20 Cycles per axis
Current Requirements	60 mA at 24 VDC

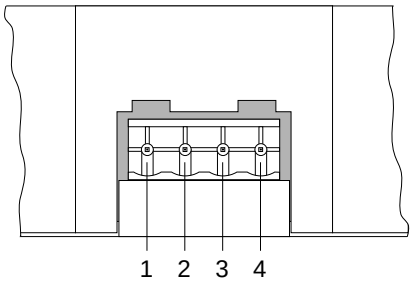
3.1 Overview of Connections and Operational Elements



1 Display Module Connector
2 Keypad Module Connector
3 24 V Supply Voltage Connector
4 RS485 interface, 9 pin D-Type (F)
for connection to a C300 panel controller

5 - 7 Number Switch
5 Operating Mode
6 Station Number
7 Baudrate

3.1.1 Supply Voltage (24 VDC)



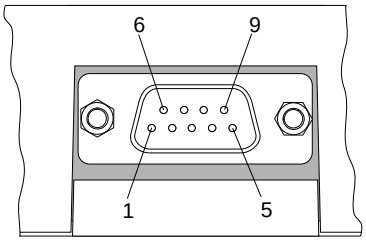
Pin		Description
1	+	+24 VDC
2	-	GND
3	⏚	Ground
4	⏚	Ground

All components must be properly grounded. (If in a rack, the ground cable length must not exceed 15 cm.). This is particularly important for the reasons listed below.

- A low resistance path from all parts of a system to earth minimizes exposure to shock in the event of short circuits or equipment malfunction.
- PANELWARE operator panels require proper grounding for correct operation.

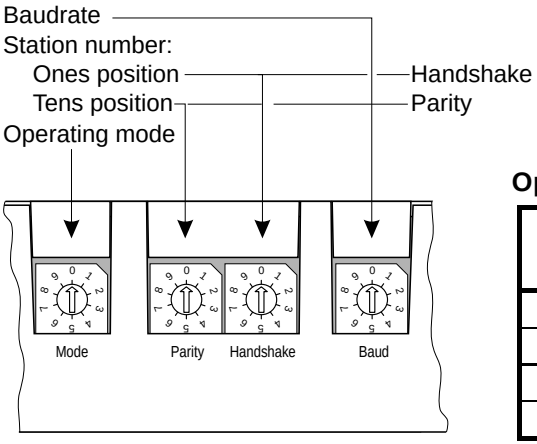
The importance of a properly grounded system cannot be over emphasized.

3.1.2 RS485/RS422 Interface



	Description	
Pin	**RS485**	**RS422**
1	Shield	
2	NC	NC
3	DATA	RxD
4	reserved	TxD
5	GND	
6	5 V (max. 150 mA)	
7	NC	NC
8	DATA	RxD
9	reserved	TxD

3.1.3 Number Dials



Operating Mode

Switch setting	Parity
0	VT100 emulation
1	Reserved
2	Slave mode
3 - 9	Not allowed

Station Number or Parity / Handshake

These number switches have a different function depending on the operating mode selected:

1. Operating Mode 2 (Slave Mode):

Switch	Meaning
Parity	Tens places on the station number
Handshake	Ones place on the station number

For the station number, switch settings between 00 and 99 are allowed.

2. Operating Mode 0 (VT100emulation):

Switch Setting	Parity	Handshake
0	None	No handshake
1	Odd	XON/XOFF operation

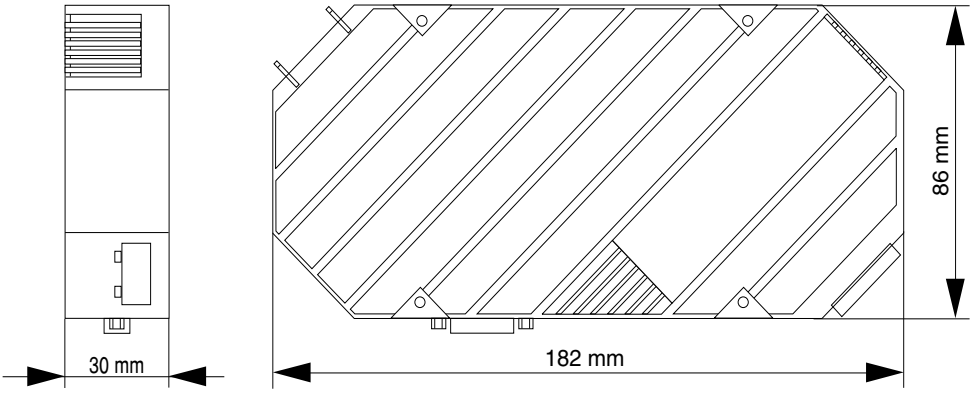
3.1.4 Baudrate

Depending on the mode of operation the following baudrates are possible:

	Baudrate	
Switch Setting	**Operating Mode 0 (VT100 emulation)**	**Operating Mode 2 (Slave mode)**
0	300	9600
1	1200	19200
2	4800	93750
3	9600	187500
4	19200	500000
5	38400 (only in XON/XOFF operation)	Not allowed
6	Not allowed	Not allowed
7	Not allowed	Not allowed
8	Not allowed	Not allowed
9	Not allowed	Not allowed

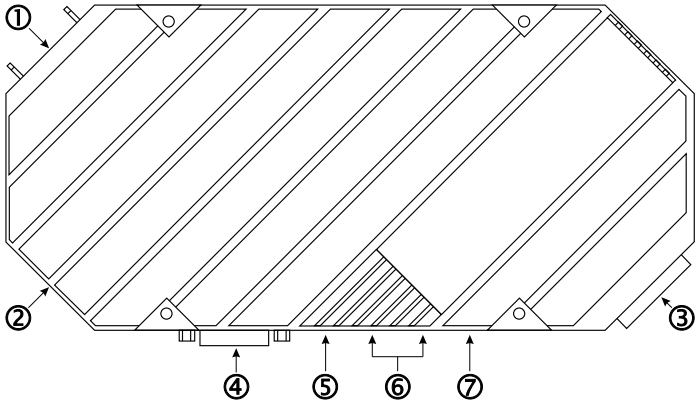
Note:
A minimum baudrate of 187500 can be used for master-slave operation between a C300 and C110 controllers.

4 Panel Controller C130



Technical Data	
Interface	CAN
Control	VT100 Command Set (CAN expansions)
Supply	24 VDC (min. 18 VDC, max. 30 VDC)
Connection of	
Display Modules	1
Keypad Modules	max. 7
Temperature	
Operating	0 to 50 °C (32 to 122 °F)
Storage	-20 to 60 °C (-4 to 140 °F)
Relative Humidity	
Operating	10 to 95 % (non-condensing)
Storage	10 to 95 % (non-condensing)
Shock	Conforms to IEC 60068-2-27 15g equivalent, 150 m/sec^2, 11 msec, 3 axes (positive and negative)
Vibration	Conforms to IEC 60068-2-6 1g equivalent, 10-58 Hz; 0.075 mm 58-150 Hz; 9.8m/sec^2 20 Cycles per axis
Current Requirements	95 mA at 24 VDC

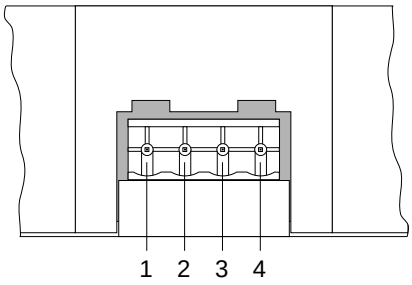
4.1 Overview of Connections and Operational Elements



1 Display Module Connector
2 Keypad Module Connector
3 24 V Supply Voltage Connector
4 CAN interface, 9 pin D-Type (M)
for connection to a PC (PCS) or a PLC

5 - 7 Number Switch
5 Not used
6 Baudrate / CAN Node
7 Not used

4.1.1 Supply Voltage (24 VDC)



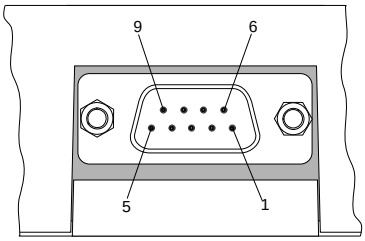
Pin		Description
1	+	+24 VDC
2	-	GND
3	⏚	Ground
4	⏚	Ground

All components must be properly grounded. (If in a rack, the ground cable length must not exceed 15 cm.). This is particularly important for the reasons listed below.

- A low resistance path from all parts of a system to earth minimizes exposure to shock in the event of short circuits or equipment malfunction.
- PANELWARE operator panels require proper grounding for correct operation.

The importance of a properly grounded system cannot be over emphasized.

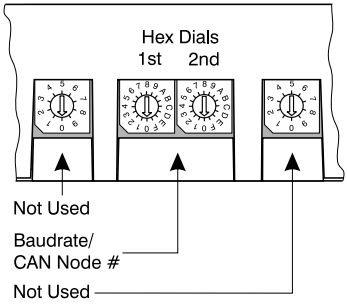
4.1.2 CAN Interface

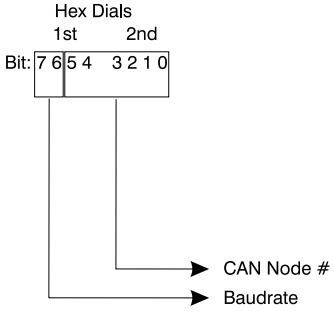


Pin	Signal	Description
1	NC	not connected
2	**CAN L**	CAN Low
3	**CAN GND**	Can Ground
4	NC	not connected
5	NC	not connected
6	NC	not connected
7	**CAN H**	CAN High
8	NC	not connected
9	NC	not connected

4.1.3 Number Dials

The hex dials are used to set the baudrate and the CAN node number. The two other dials are presently not being used. Each hex dial has a 4 bit value range. The first 2 bits of the first hex dial set the baudrate. The second 2 bits of the first hex dial along with all 4 bits of the second hex dial set the CAN node number. 1 - 32 are valid CAN node numbers, 0 and 33 - 63 are invalid. Baudrates are set as follows;
(00 - 250 KBaud, 01 - 125 KBaud, 10 - 20 KBaud and 11 - 500 KBaud).





Hex Dials

1st	2nd	Baudrate	CAN Node#
0	0	N/A	Invalid
0	1 - F	250 KBaud	1 -15
1	0 - F	250 KBaud	16 - 31
2	0	250 KBaud	32
2	1 - F	N/A	Invalid
3	0 - F	N/A	Invalid

Hex Dials

1st	2nd	Baudrate	CAN Node#
8	0	N/A	Invalid
8	1 - F	20 KBaud	1 -15
9	0 - F	20 KBaud	16 - 31
A	0	20 KBaud	32
A	1 - F	N/A	Invalid
B	0 - F	N/A	Invalid

Hex Dials

1st	2nd	Baudrate	CAN Node#
4	0	N/A	Invalid
4	1 - F	125 KBaud	1 -15
5	0 - F	125 KBaud	16 - 31
6	0	125 KBaud	32
6	1 - F	N/A	Invalid
7	0 - F	N/A	Invalid

Hex Dials

1st	2nd	Baudrate	CAN Node#
C	0	N/A	Invalid
C	1 - F	500 KBaud	1 -15
D	0 - F	500 KBaud	16 - 31
E	0	500 KBaud	32
E	1 - F	N/A	Invalid
F	0 - F	N/A	Invalid

4.1.4 CAN Identifier

The CAN send and receive identifiers are calculated as follows using the CAN node number:

sendID = 1054 + (CAN node number - 1) x 16
[sending from PCC to control panel]

receiveID = 1054 + (CAN node number - 1) x 16 **+ 1**
or receiveID = sendID **+ 1**
[receiving from the control panel]

CAN ID collisions are not possible if all CAN bus participants have a different node number from 1 to 32.

4.1.5 Data Transfer

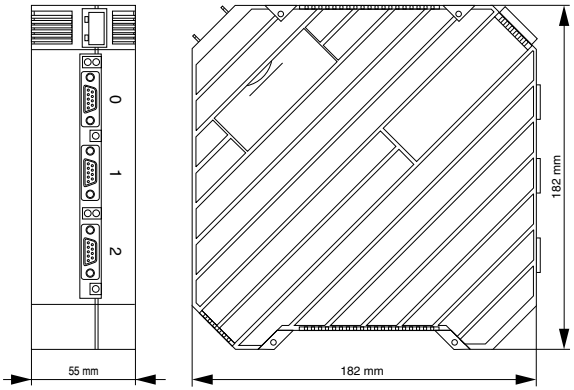
On the C130 CAN Controller, data is transferred to and from the control panel using CAN frames. A maximum of 8 bytes of data can be transferred with a CAN frame. If the data is longer than 8 bytes, it must be sent or received in blocks. The minimum delay is the time between individual CAN frames when sending information from the control panel to the PCC. The PCC must be able to receive CAN frames containing 8 bytes of data from the control panel at the following intervals when the minimum delay is set to 0 msec, otherwise the the delay must be set higher:

Baudrate	**Interval**
500 KBaud	1 msec
250 KBaud	2 msec
125 KBaud	2 msec
20 KBaud	7 msec

The C130 CAN Controller can receive and process CAN frames with 8 bytes of data from the PCC every 6 msec. Therefore, the PCC should not continually send frames at a higher speed. A higher short-term data rate is possible because the C130 has a 256 byte receive buffer.

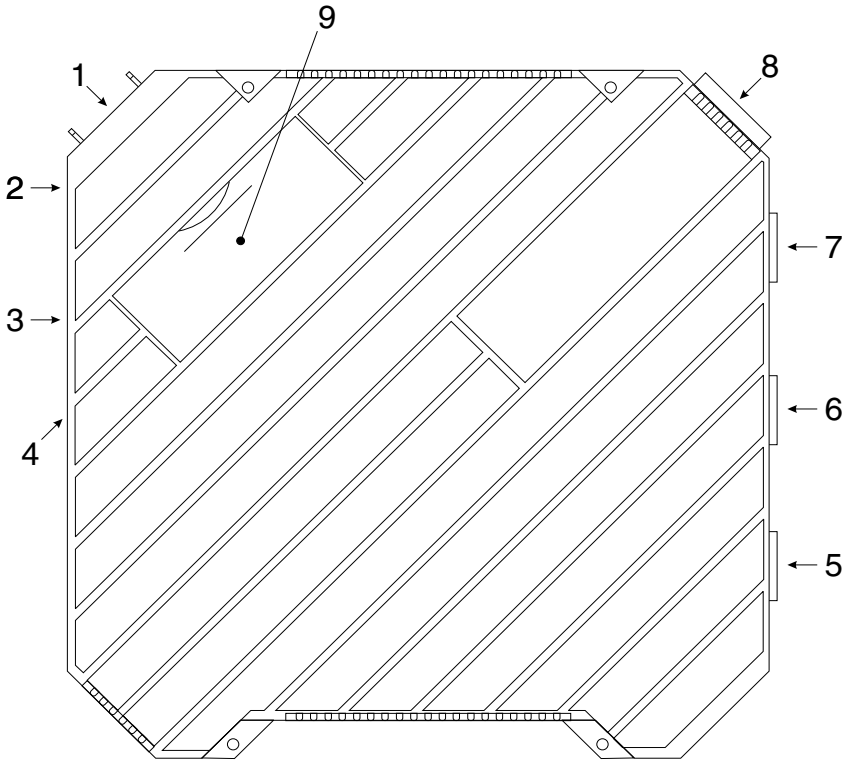
Note:
Additional VT100 commands are available for the C130 controller. A description of these commands can be found in Appendix B "VT100 Command Set".

5 Panel Slave Controller C200



Technical Data	
Interfaces	IF0:RS232 (not electrically isolated) IF1:RS232 (not electrically isolated) IF2:RS422/RS485 (electrically isolated)
Programming	PG2000 (PL2000); PANELWARE software
Power Supply	24 VDC (min. 18 VDC, max. 30 VDC)
Real Time Clock	YES (non-volatile)
Connection of .... **Display Modules** **Keypad Modules**	 1 max. 7
Temperature **Operating** **Storage**	 0 to 50 °C (32 to 122 °F) -20 to 60 °C (-4 to 140 °F)
Relative Humidity **Operating** **Storage**	 10 to 95 % (non-condensing) 10 to 95 % (non-condensing)
Shock	Conforms to IEC 60068-2-27 15g equivalent, 150 m/sec^2, 11 msec, 3 axes (pos. and neg.)
Vibration	Conforms to IEC 60068-2-6 1g equivalent, 10-58 Hz; 0.075 mm 58-150 Hz; 9.8m/sec^2 20 Cycles per axis
Memory **User RAM** **System ROM** **User ROM**	 256 kByte 256 kByte 256 kByte
Current Requirements	110 mA at 24 VDC

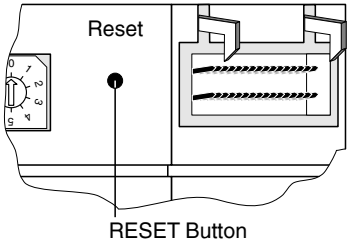
5.1 Overview of Connections and Operational Elements



1 Display Module
2 RESET Button
3 Number Switch - Operating Mode
4 Keypad Module Connection
5 IF2: RS422/RS485
6 IF1: RS232
7 IF0: RS232 (to PC)
8 Supply Voltage Connection (24 VDC)
9 Cover for Lithium Battery

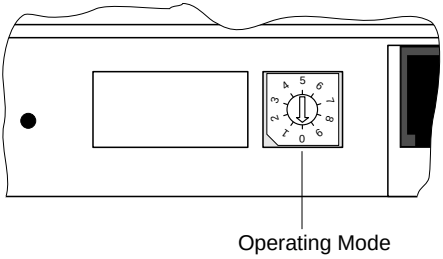
5.1.1 RESET Button

A hardware reset can be executed with this key. Depending on the number switch settings and the boot selection switch setting, different functions can be executed. These functions are all explained in the description of the connections and operational elements (see *General Information about* C200/C300).



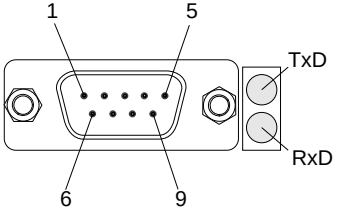
5.1.2 Number Dial - Operation Mode

The mode of operation for the panel controller is set with number switch four (see *General Information about* C2xx/C300).



5.1.3 IF0 - RS232

9 Pin D-Type Connector (M)

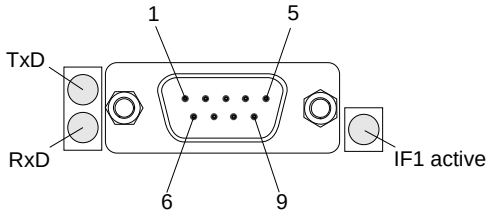


LED	Meaning
TxD	Send data over interface
RxD	Receive data over interface

Pin	Description	
1	NC	
2	RxD	Receive Data
3	TxD	Transmit Data
4	+ 5 V	Power Supply (200 mA)
5	GND	Ground
6	NC	
7	RTS	Request To Send
8	CTS	Clear To Send
9	NC	

5.1.4 IF1 - RS232

9 Pin D-Type Connector (M)

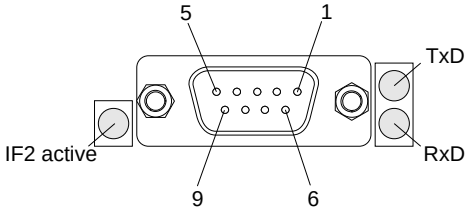


LED	Meaning
TxD	Send data over interface
RxD	Receive data over interface
IF1 active	Interface IF1 is active and IF2 is inactive.

Pin	Description	
1	NC	
2	RxD	Receive Data
3	TxD	Transmit Data
4	12 V	Power Supply for external converter (200 mA)
5	GND	
6	NC	
7	RTS	Request To Send
8	CTS	Clear To Send
9	NC	

5.1.5 IF2 - RS422 / RS485

9 Pin D-Type Connector (F)

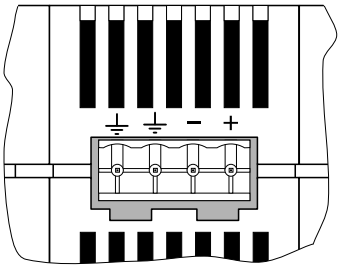


LED	Meaning
TxD	Send data over interface
RxD	Receive data over interface
IF2 active	Interface IF2 is active and IF1 is inactive.

	Description	
Pin	RS422	RS485
1	Shield	
2	TxD	NC
3	RxD	DATA
4	NC	NC
5	GND	
6	+5V$_{DC}$ (200 mA) Galvanic isolation	
7	$\overline{\text{TxD}}$	NC
8	$\overline{\text{RxD}}$	$\overline{\text{DATA}}$
9	NC	NC

Interfaces IF1 and IF2 are basically only one interface. Because of the triple assignment with different interface types, they are however routed through one male and one female connector. This means that only one of the interfaces can be used at any given time. The active interface is indicated with an LED.

5.1.6 Supply Voltage (24 VDC)



Pin		Description
1	+	+24 VDC
2	-	GND
3	⏚	Ground
4	⏚	Ground

All components must be properly grounded. (If in a rack, the ground cable length must not exceed 15 cm.). This is particularly important for the reasons listed below.

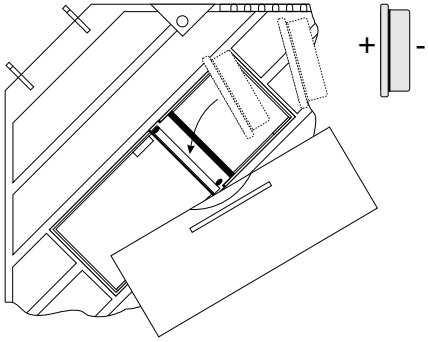
- A low resistance path from all parts of a system to earth minimizes exposure to shock in the event of short circuits or equipment malfunction.
- PANELWARE operator panels require proper grounding for correct operation.

The importance of a properly grounded system cannot be over emphasized.

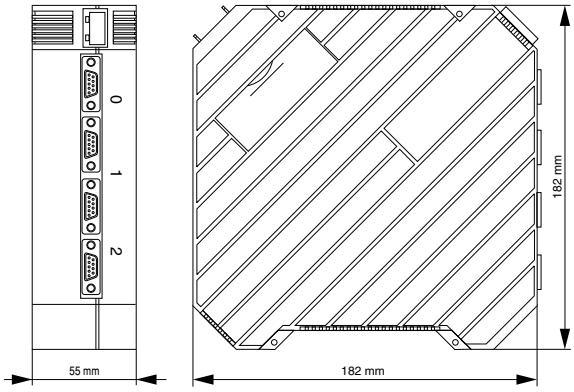
5.1.7 Lithium Battery

The lithium battery is held in its own compartment and is covered for protection and for safety reasons.

Attention
Lithium batteries fall into the category of harmful waste. Please consider the legal provision regarding disposal in your area.

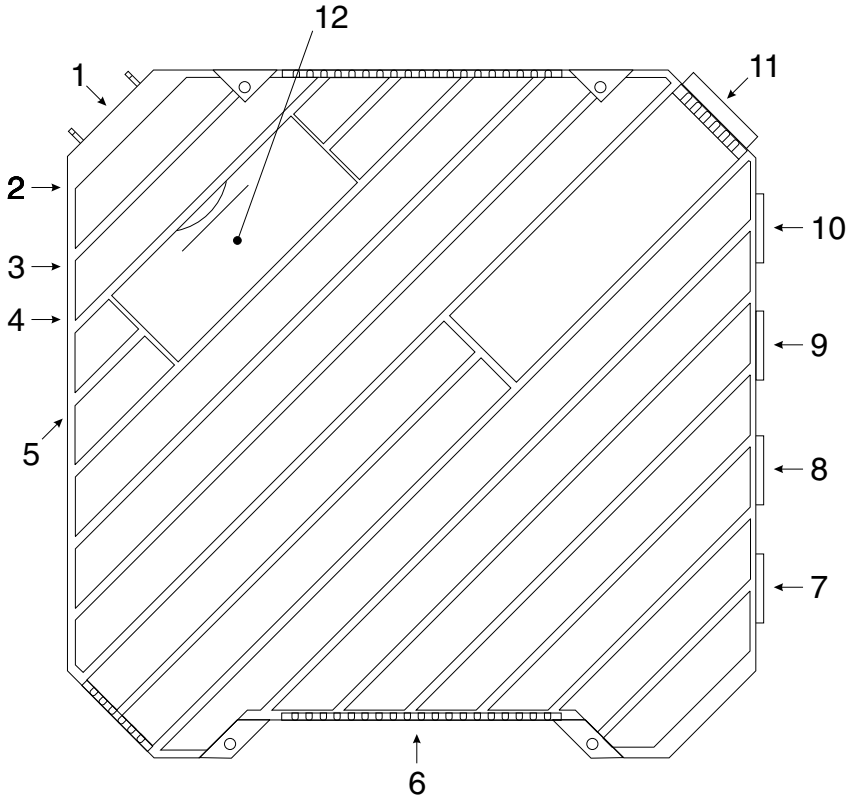


6 Panel Slave Controller C220/C221



Technical Data		
Controller	**C220**	**C221**
Interfaces	IF0:RS232 (not electrically isolated) IF1:RS232 (not electrically isolated) IF2:RS422/RS485 (electrically isolated) IF3:CAN (electrically isolated)	
Programming	PG2000 (PL2000); PANELWARE software	
Power Supply	24 VDC (min. 18 VDC, max. 30 VDC)	
Real Time Clock	YES (non-volatile)	
Connection of .... **Display Modules** **Keypad Modules**	 1 max. 7	
Temperature **Operating** **Storage**	 0 to 50 °C (32 to 122 °F) -20 to 60 °C (-4 to 140 °F)	
Relative Humidity **Operating** **Storage**	 10 to 95 % (non-condensing) 10 to 95 % (non-condensing)	
Shock	Conforms to IEC 60068-2-27 15g equivalent, 150 m/sec^2, 11 msec, 3 axes (pos. and neg.)	
Vibration	Conforms to IEC 60068-2-6 1g equivalent, 10-58 Hz; 0.075 mm 58-150 Hz; 9.8m/sec^2 20 Cycles per axis	
Memory **User RAM** **System ROM** **User ROM**	 256 KBytes 256 Kbytes 256 KBytes	 1 Mbytes 512 Kbytes 512 Kbytes
Current Requirements	130 mA at 24 VDC	

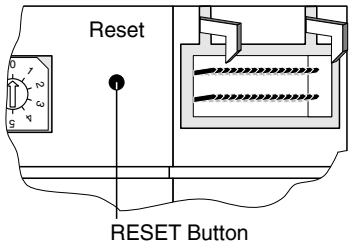
6.1 Overview of Connections and Operational Elements



1 Display Module
2 RESET Button
3 Number Switch - Operating Mode
4 Number Switch - CAN Station
5 Keypad Module Connection
6 LEDs
7 IF3: CAN
8 IF2: RS422/RS485
9 IF1: RS232
10 IF0: RS232 (to PC)
11 Supply Voltage Connection (24 VDC)
12 Cover for Lithium Battery

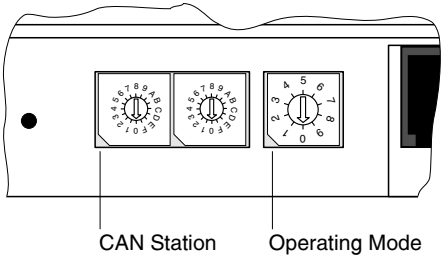
6.1.1 RESET Button

A hardware reset can be executed with this key. Depending on the number switch settings and the boot selection switch setting, different functions can be executed. These functions are all explained in the description of the connections and operational elements (see *General Information about* C200/C300).



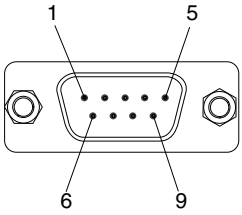
6.1.2 Number Dials - Operation Mode/ CAN Station

The mode of operation for the panel controller is set with number switch four (see *General Information about* C2xx/C300).
The CAN node number can be set using the CAN Station dials. The actual node number in the CAN network is to be set.



6.1.3 IF0 - RS232

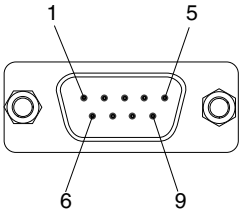
9 Pin D-Type Connector (M)



Pin	Description	
1	NC	
2	RxD	Receive Data
3	TxD	Transmit Data
4	+ 5 V	Power Supply (200 mA)
5	GND	Ground
6	NC	
7	RTS	Request To Send
8	CTS	Clear To Send
9	NC	

6.1.4 IF1 - RS232

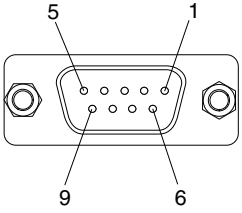
9 Pin D-Type Connector (M)



Pin	Description	
1	NC	
2	RxD	Receive Data
3	TxD	Transmit Data
4	12 V	Power Supply for external converter (200 mA)
5	GND	
6	NC	
7	RTS	Request To Send
8	CTS	Clear To Send
9	NC	

6.1.5 IF2 - RS422 / RS485

9 Pin D-Type Connector (F)

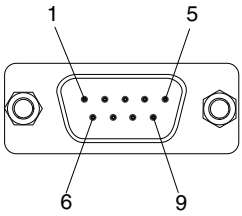


	Description	
Pin	RS422	RS485
1	Shield	
2	TxD	NC
3	RxD	DATA
4	NC	NC
5	GND	
6	+5V$_{DC}$ (200 mA) Galvanic isolation	
7	$\overline{TxD}$	NC
8	$\overline{RxD}$	$\overline{DATA}$
9	NC	NC

Interfaces IF1 and IF2 are basically only one interface. Because of the triple assignment with different interface types, they are however routed through one male and one female connector. This means that only one of the interfaces can be used at any given time. The active interface is indicated with an LED.

6.1.6 IF3 - CAN

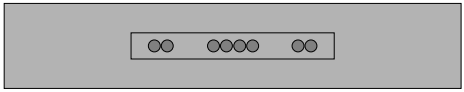
9 Pin D-Type Connector (M)



Pin	Description	
1	NC	Not used
2	CAN_L	CAN low
3	CAN_GND	CAN ground
4	NC	Not used
5	NC	Not used
6	CAN_GND	CAN ground
7	CAN_H	CAN high
8	NC	Not used
9	NC	Not used

6.1.7 Interface LEDs

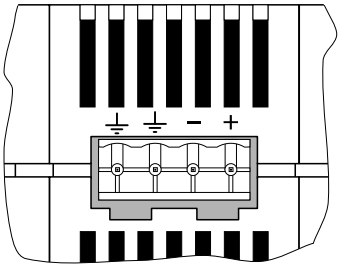
C22x panel controllers are equipped with several status LEDS.



Back side of control panel

Left Side:	RX and TX interface IF0
Middle / Left Side:	Interface IF1 used
Middle:	RX and TX interface IF2
Middle / Right Side:	Interface IF2 used
Right Side:	RX and TX interface IF3

6.1.8 Supply Voltage (24 VDC)



Pin		Description
1	+	+24 VDC
2	-	GND
3	⏚	Ground
4	⏚	Ground

All components must be properly grounded. (If in a rack, the ground cable length must not exceed 15 cm.). This is particularly important for the reasons listed below.

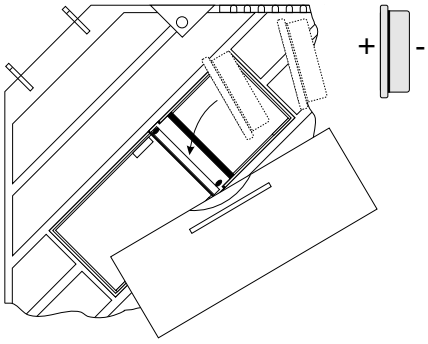
- A low resistance path from all parts of a system to earth minimizes exposure to shock in the event of short circuits or equipment malfunction.
- PANELWARE operator panels require proper grounding for correct operation.

The importance of a properly grounded system cannot be over emphasized.

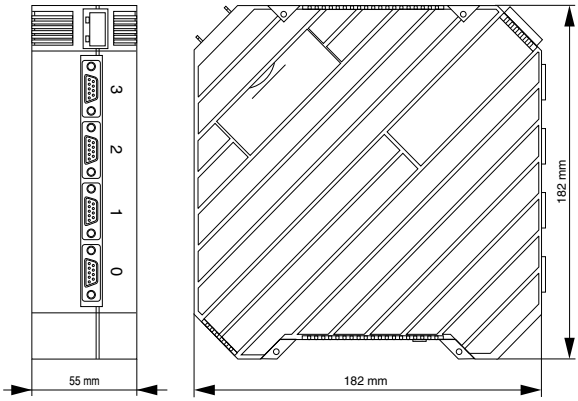
6.1.9 Lithium Battery

The lithium battery is held in its own compartment and is covered for protection and for safety reasons.

Attention
Lithium batteries fall into the category of harmful waste. Please consider the legal provision regarding disposal in your area.

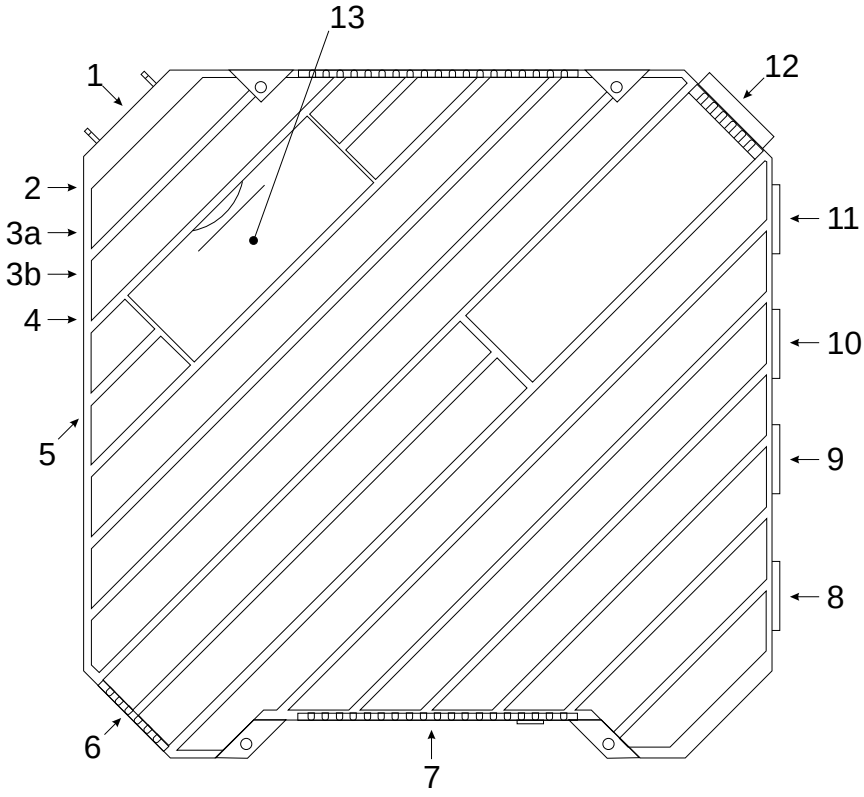


7 Panel Slave Controller C300



Technical Data	
Interfaces	IF0:RS232 (modem capable, not electrically isolated) IF1:RS232 / TTY (Software switched, not electrically isolated) IF2:RS422 (electrically isolated) IF3:RS485 (network capable, electrically isolated)
Programming	PG2000 (PL2000); PANELWARE software
Power Supply	24 VDC (min. 18 VDC, max. 30 VDC)
Real Time Clock	YES (non-volatile)
Connection of .... **Display Modules** **Keypad Modules**	 1 max. 7
Expansion	Connection of max. three C110 panel slave controllers
Temperature **Operating** **Storage**	 0 to 50 °C (32 to 122 °F) -20 to 60 °C (-4 to 140 °F)
Relative Humidity **Operating** **Storage**	 10 to 95 % (non-condensing) 10 to 95 % (non-condensing)
Shock	Conforms to IEC 60068-2-27 15g equivalent, 150 m/sec^2, 11 msec, 3 axes (pos. and neg.)
Vibration	Conforms to IEC 60068-2-6 1g equivalent, 10-58 Hz; 0.075 mm 58-150 Hz; 9.8m/sec^2 20 Cycles per axis
Memory **User RAM** **System Rom** **User ROM**	 256 kByte 256 kByte 256 kByte
Power Consumption	340 mA at 24 VDC

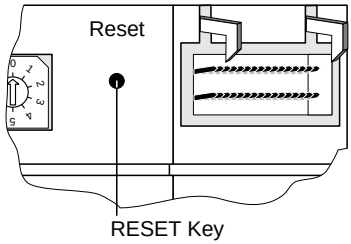
7.1 Overview of Connections and Operational Elements



1 Display Module
2 RESET Button
3 Number Switch - Station Number or Special Functions
4 Number Switch - Operating Mode
5 Keypad Module Connection
6 Boot-Selection Switch
7 Memory Card Slot
8 IF0: RS232, modem capable
9 IF1: RS232, TTY
10 IF2: RS422, RS485
11 IF3: RS485
12 Supply Voltage Connection (24 VDC)
13 Cover for Lithium Battery

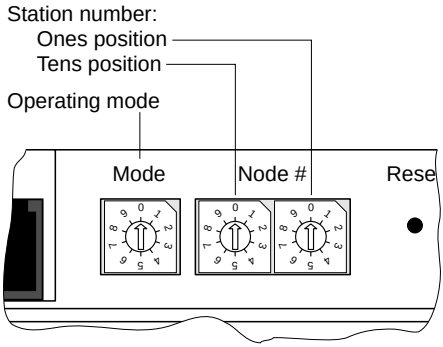
7.1.1 RESET Button

A hardware reset is executed with this key. Depending on the number switch setting and the boot selection switch setting, different functions can be performed. These functions are explained in the description of connections and operational elements (see *General Information about* C200/C300).



7.1.2 Number Dials - Station Number

These number switches are reserved for future PROFIBUS applications. A station number is set with these switches (for networking over the IF3 interface).

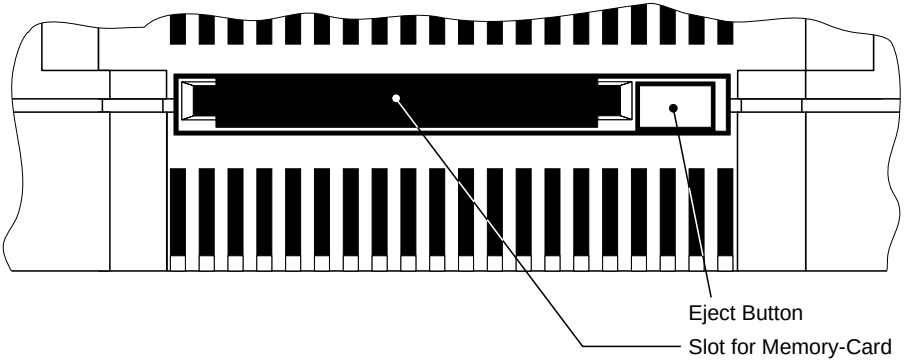


7.1.3 Number Dial - Operating Mode (baudrate)

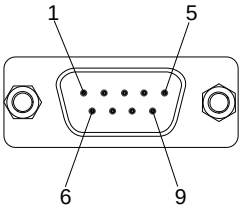
With number switch 4, the operating mode of the panel controller is defined. In addition, the baudrate can be set for future PROFIBUS applications.

7.1.4 Slot for Memory Card

The Memory Card can be called upon to replace the current version of operating system on the C300 panel controller.

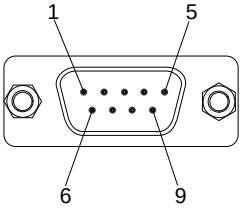


7.1.5 IF0 - RS232



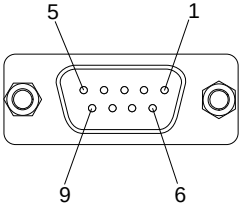
Pin	Description	
1	DCD	Data Carrier Detected
2	RxD	Receive Data
3	TxD	Transmit Data
4	DTR	Data Terminal Ready
5	GND	Ground
6	DSR	Data Set Ready
7	RTS	Request To Send
8	CTS	Clear To Send
9	RI	Ring Indicator

7.1.6 IF1 - RS232 / TTY



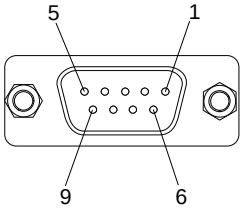
	Description	
Pin	RS232	TTY
1	NC	TxD
2	RxD	20 mA
3	TxD	NC
4	NC	RxD
5	Ground	NC
6	NC	TxD Return $\overline{\text{TxD}}$
7	RTS	20 mA
8	CTS	NC
9	NC	RxD Return $\overline{\text{RxD}}$

7.1.7 IF2 - RS422 / RS485



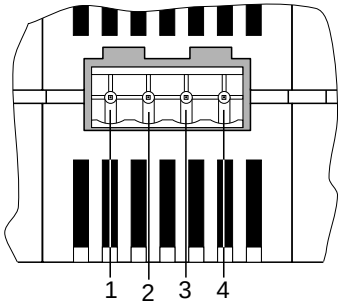
	Description	
Pin	RS422	RS485
1	NC	NC
2	TxD	NC
3	RxD	DATA
4	NC	NC
5	GND	NC
6	+5V$_{DC}$ (200 mA)	NC
7	$\overline{\text{TxD}}$	NC
8	$\overline{\text{RxD}}$	$\overline{\text{DATA}}$

7.1.8 IF3 - RS485



Pin	Description	
1	Shield	Cable shielding
2	NC	
3	DATA	
4	CNTRL	Control line
5	GND	Ground
6	+5V	Potential Isolated Supply (200 mA)
7	NC	
8	$\overline{\text{DATA}}$	
9	$\overline{\text{CNTRL}}$	Control line

7.1.9 Supply Voltage (24 VDC)



Pin		Description
1	+	+24 VDC
2	-	GND ⊥
3	⏚	Ground
4	⏚	Ground

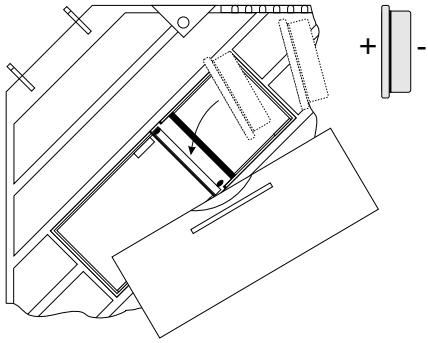
All components must be properly grounded. (If in a rack, the ground cable length must not exceed 15 cm.). This is particularly important for the reasons listed below.

- A low resistance path from all parts of a system to earth minimizes exposure to shock in the event of short circuits or equipment malfunction.
- PANELWARE operator panels require proper grounding for correct operation.

The importance of a properly grounded system cannot be over emphasized.

7.1.10 Lithium Battery

The lithium battery is held in its own compartment and is covered for protection and for safety reasons.



Attention
Lithium batteries fall into the category of harmful waste. Please consider the legal provision regarding disposal in your area.

8 General Information about C2xx/C300

8.1 Loading and Starting Panel Programs

A panel program is created by means of the PANELWARE Configuration Software (PCS) and the transferred to the panel through the serial interface. This transfer is done in *Teach Mode*. To start the application you must switch over to *RUN Mode*.

8.1.1 Load Panel Program

1. Make the connection between the PC (COM1 or COM2) and the Panel Controller (always IF0). A serial cable is used for this (see Appendix A).
2. Set boot selection switch to 1 (only C300)
3. Select *Teach Mode* (position 7)
4. Press reset key
5. Wait until “Teach-Mode” is displayed
6. Start the transfer from the PCS
7. Wait until the PCS acknowledges that the entire panel program has been transferred

With PCS V2.0 and higher, the panel program can also be downloaded in RUN mode if IF0 is not being used for communication to the PLC or a printer.

8.1.2 Start the Panel Program

1. Set boot selection switch to 1 (only C300)
2. Select *Run Mode* (position 5)
3. Make the connection between the PLC and the panel controller (see PANELWARE Application Manual).
4. Press Reset button

8.2 Reloading the Operating System

The operating system of the panel controller can be reloaded from the PCS. The steps for transfer are identical with *"Load Panel Program"*.

8.2.1 Update Mode

C200, C220, C221 Mode 6
C300 Mode 7

8.3 Mode Settings

8.3.1 C200, C220, C221

No.	PANELWARE Operating System	PCC Operating System
0	not allowed	Warm Restart
1	not allowed	Cold Start
2	not allowed	Warm Restart
3	not allowed	Warm Restart
4	not allowed	Warm Restart
5	Run Mode	Warm Restart
6	System Download	System Download
7	Teach Mode	Reset
8	not allowed	Diagnose
9	not allowed	Warm Restart

8.32 C300

No.	Function	Baudrate
0	Run Mode - Profibus	9,600 Baud
1	Run Mode - Profibus	19,200 Baud
2	Run Mode - Profibus	93,750 Baud
3	Run Mode - Profibus	187,500 Baud
4	Run Mode - Profibus	500,000 Baud
5	Run Mode	N/A
6	not allowed	N/A
7	Teach Mode and OS Download	N/A
8	not allowed	N/A
9	not allowed	N/A

9 Accessories

There are certain accessories included with every panel controller. These are packed with the module.

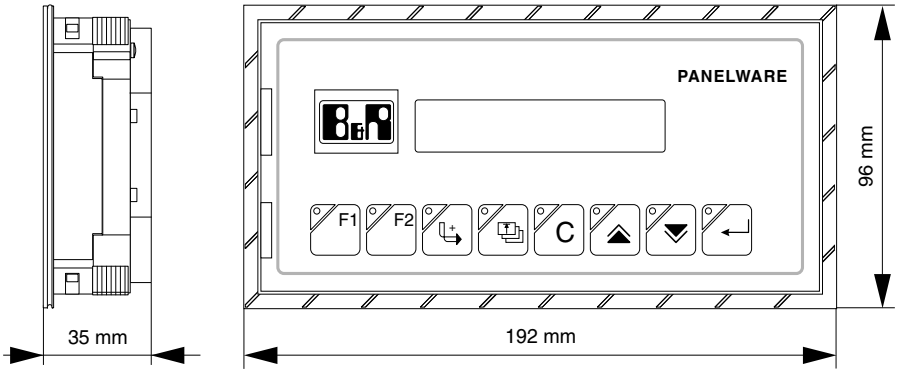
Accessories	Amount
Termination resistor (connected in the output of the last keypad module)	1
Sealant tube for making a seal between the panel and the front plate	1
Lithium Battery	1
Front foils (6 pieces) for keypad modules with 4 keys	1
Front foils (6 pieces) for keypad modules with 8 keys	1
Front foils (6 pieces) for keypad modules with 16 and 12+4 keys	1
Screws for connecting panel controller to display or keypad modules	4

CHAPTER 6
COMPACT AND MICRO HMI

1 Compact and Mirco HMI

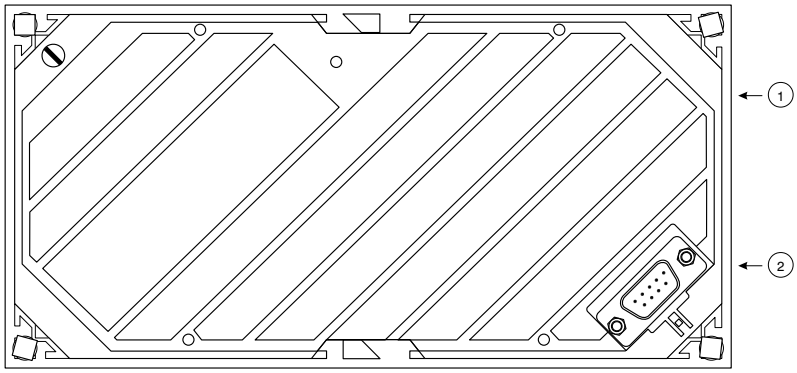
- P120 / P121 Compact HMI
- P125 / P126 Compact HMI
- P150 Micro HMI

2 P120 / P121 Compact HMI



Technical Data		
HMI	**P120**	**P121**
Interface	RS232 (not electrically isolated)	
Control	Pictures created with PANELWARE Configuration Software (V1.71 and higher), application stored in Compact HMI (32 kBytes EEPROM, max. 250 pictures)	Controlled using ESC sequences (no memory in the P121)
Supply	5.2 VDC (min. 5.0 VDC, max. 5.5 VDC)	
Display	2 x 20 LCD (background lighting)	
Keypad	8 keys with key LEDs, legend strips	
Temperature **Operating** **Storage**	 0 to 50 °C (32 to 122 °F) -20 to 60 °C (-4 to 140 °F)	
Relative Humidity **Operating** **Storage**	 10 to 90 % (non-condensing) 10 to 90 % (non-condensing)	
Shock	Conforms to IEC 60068-2-27 15g equivalent, 150 m/sec^2, 11 msec, 3 axes (pos and neg)	
Vibration	Conforms to IEC 60068-2-6 1g equivalent, 10-58 Hz; 0.075 mm 58-150 Hz; 9.8m/sec^2 20 Cycles per axis	
Current Requirements	200 mA at 5.2 VDC	

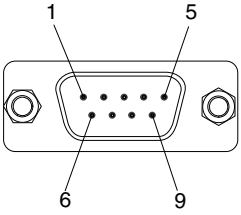
2.1 Overview of Connections and Operational Elements



1 Operation Mode Switch
2 RS232 Interface

2.1.1 RS232 Interface

A 9 pin D-type male connector can be found on the back of the COMPACT MMI:



Pin	Description	
1	NC	Not used
2	RxD	Receive Data
3	TxD	Transmit Data
4	+5 V	Power supply for HMI
5	GND	Reference potential (ground)
6	+5 V	Power supply for HMI
7	NC	Not used
8	NC	Not used
9	+5 V	Power supply for HMI

Attention: The panel is not electrically isolated. All interface signals refer to ground!

2.1.2 Supply Voltage

The panel is supplied through pins 4 and 5 (or 6 or 9) of the 9 pin D-type (M) connector. The power supply must match the following specifications:

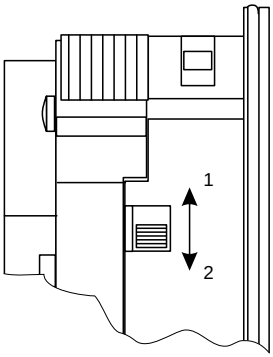
Voltage:	typ. 5.2 V (min. 5 V, max. 5.5 V)
Current:	200 mA
Temperature Coefficient:	max. 1 mV/°C
Ripple:	max. 50 mV

2.1.3 Operating Mode Switch (only P120)

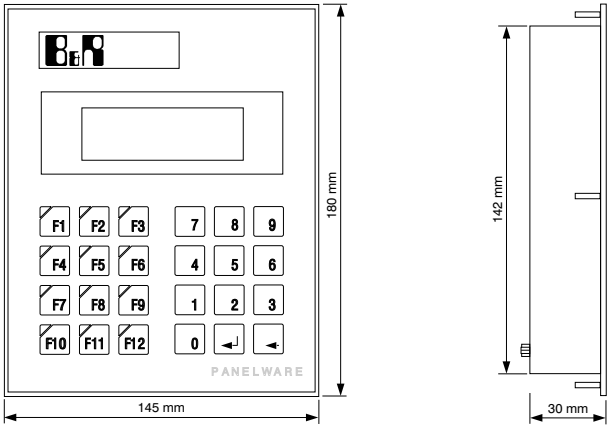
This switch is only found on the COMPACT MMI P120 and not on the P121. Switching between "Teach Mode" and "Run Mode" is done with this switch.

- **Teach Mode (Position 2)**
  In this mode of operation, a project created with the PANELWARE Configuration Software can be transferred from a PC to the P120. If the P120 is switched on in this mode of operation, the text "TEACH-MODE WAITING FOR DATA" is displayed on the display.

- **Run Mode (Position 1)**
  If the P120 is switched on in this mode of operation, the project which has been downloaded to the panel is started.

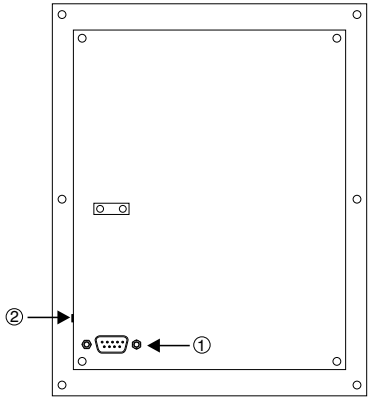


2 P125 / P126 Compact HMI



Technical Data		
HMI	**P125**	**P126**
Interface	RS232 (not electrically isolated)	
Control	Pictures created with PANELWARE Configuration Software (V1.71 and higher), application stored in Compact HMI (32 kBytes EEPROM, max. 250 pictures)	Controlled using ESC sequences (no memory in the P121)
Supply	5.2 VDC (min. 5.0 VDC, max. 5.5 VDC)	
Display	2 x 20 LCD (background lighting)	
Keypad	12 function keys with legend strips ,12 key number block	
Temperature **Operating** **Storage**	 0 to 50 °C (32 to 122 °F) -20 to 60 °C (-4 to 140 °F)	
Relative Humidity **Operating** **Storage**	 10 to 90 % (non-condensing) 10 to 90 % (non-condensing)	
Shock	Conforms to IEC 60068-2-27 15g equivalent, 150 m/sec^2, 11 msec, 3 axes (pos and neg)	
Vibration	Conforms to IEC 60068-2-6 1g equivalent, 10-58 Hz; 0.075 mm 58-150 Hz; 9.8m/sec^2 20 Cycles per axis	
Current Requirements	340 mA at 5.2 VDC	

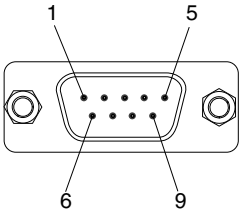
2.1 Overview of Connections and Operational Elements



1 RS232 Interface
2 Operation Mode Switch

2.1.1 RS232 Interface

A 9 pin D-type male connector can be found on the back of the COMPACT MMI:



Pin	Description	
1	NC	Not used
2	RxD	Receive Data
3	TxD	Transmit Data
4	+5 V	Power supply for HMI
5	GND	Reference potential (ground)
6	+5 V	Power supply for HMI
7	NC	Not used
8	NC	Not used
9	NC	Not used

Attention: The panel is not electrically isolated. All interface signals refer to ground!

2.1.2 Supply Voltage

The panel is supplied through pins 4 and 5 (or 6 or 9) of the 9 pin D-type (M) connector. The power supply must match the following specifications:

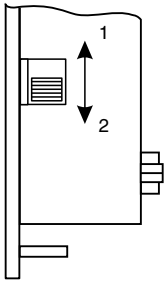
Voltage:	typ. 5.2 V (min. 5 V, max. 5.5 V)
Current:	340 mA
Temperature Coefficient:	max. 1 mV/°C
Ripple:	max. 50 mV

2.1.3 Operating Mode Switch (only P125)

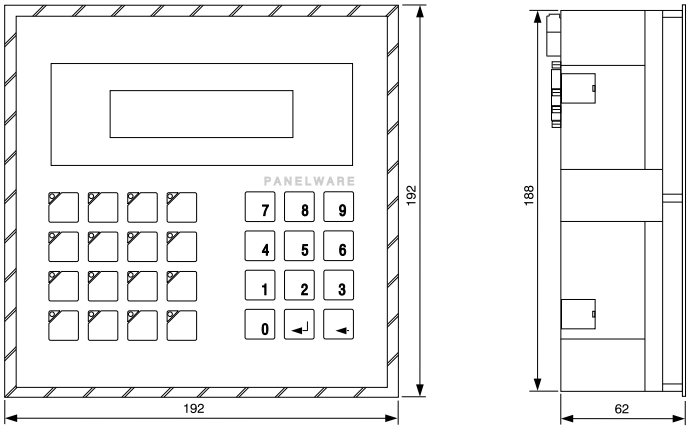
This switch is only found on the COMPACT MMI P120 and not on the P121. Switching between "Teach Mode" and "Run Mode" is done with this switch.

- **Teach Mode (Position 2)**
  In this mode of operation, a project created with the PANELWARE Configuration Software can be transferred from a PC to the P120. If the P120 is switched on in this mode of operation, the text "TEACH-MODE WAITING FOR DATA" is displayed on the display.

- **Run Mode (Position 1)**
  If the P120 is switched on in this mode of operation, the project which has been downloaded to the panel is started.

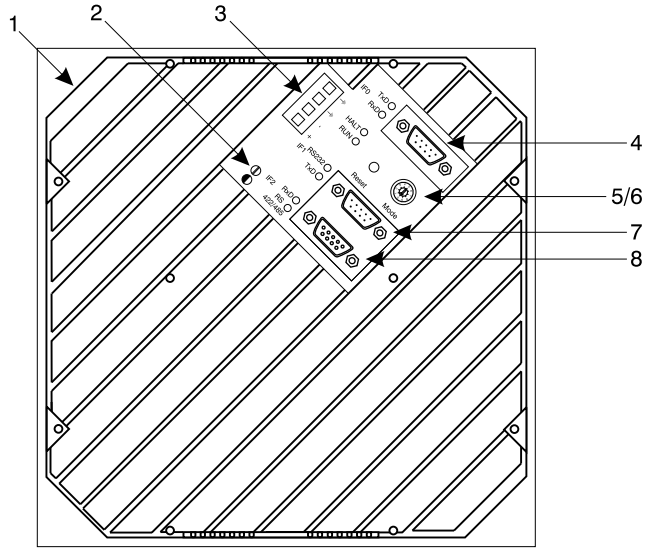


3 P150 Micro HMI



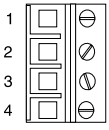
Technical Data	
Interfaces **IF0** **IF1** **IF2**	 RS232 (not electrically isolated) RS232 (not electrically isolated) RS422/485 (electrically isolated)
Control	Programmed using PANELWARE Configuration Software
Supply	24 VDC (min. 18 VDC, max. 30 VDC)
Display	2 x 20 LCD (background lighting)
Keypad **Matrix Keypad** **Numerical Keypad**	 16 keys with key LEDs 12 keys
Temperature **Operating** **Storage**	 0 to 50 °C (32 to 122 °F) -20 to 60 °C (-4 to 140 °F)
Relative Humidity **Operating** **Storage**	 10 to 90 % (non-condensing) 10 to 90 % (non-condensing)
Shock	Conforms to IEC 60068-2-27 15g equivalent, 150 m/sec^2, 11 msec, 3 axes (pos and neg)
Vibration	Conforms to IEC 60068-2-6 1g equivalent, 10-58 Hz; 0.075 mm 58-150 Hz; 9.8m/sec^2 20 Cycles per axis
Current Requirements	180 mA at 24 VDC

3.1 Overview of Connections and Operational Elements



1 Battery
2 Contrast Setting
3 Power Connection
4 Programming Interface (RS232)
5 Reset Button
6 Mode Number Dial
7 RS232 Interface
8 RS422/485 Interface

3.1.1 Supply Voltage (24 VDC)



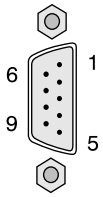
PIN	Label	Description
1	+	+24 V
2	-	GND ⊥
3	⏚	Ground
4	⏚	Ground

Power is supplied to the P150 MMI via a 4 pin terminal block. The ground pins are to be connected with ground using as short a cable as possible. If the panel is mounted in a cabinet, the length of the cable can be a max. of 15 cm

.

3.1.2 IF0 - RS232 Interface

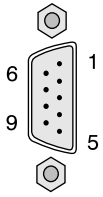
9 pin D-type connector (M)



PIN	RS232
1	NC
2	RxD
3	TxD
4	+5 V
5	GND
6	NC
7	RTS
8	CTS
9	NC

3.1.3 IF1 - RS232 Interface

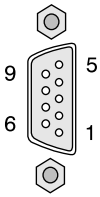
9 pin D-type connector (M)



PIN	RS232
1	NC
2	RxD
3	TxD
4	12 V
5	GND
6	NC
7	RTS
8	CTS
9	NC

3.1.4 IF2 - RS232 Interface

9 pin D-type connector (F)

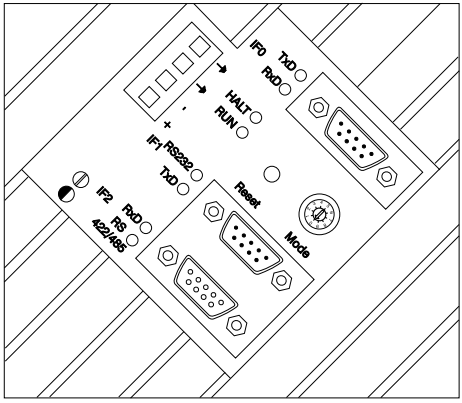


PIN	RS422	RS485
1	SHIELD	SHIELD
2	TxD	NC
3	RxD	DATA
4	NC	NC
5	GND	GND
6	+5 V	+5 V
7	$\overline{\text{TxD}}$	$\overline{\text{NC}}$
8	$\overline{\text{RxD}}$	$\overline{\text{DATA}}$
9	NC	NC

Interfaces IF1 and IF2 are basically only one interface. However, it is routed through a male and female connector because of the different interface types. All interfaces are equipped with two LEDs which indicate if data is being transmitted or received (see "LEDs").

3.1.5 LEDs

The P150 MMI is equipped with a RUN LED, a HALT LED and interface LEDs.



3.1.6 Mode Switch Number Dial

The number dial is used to set the operating mode for the controller. Different operating modes can be activated by setting the mode switch number dial to one of the following numbers. These operating modes affect how the unit behaves after a power-on.

No.	Mode	Description
0 - 4	Res.	Reserved
5	RUN MODE	Download/run program
6	BOOTSTRAP MODE	Install operating system
7	TEACH MODE	Download/run program
8,9	Res.	Reserved

A detailed description of the various modes can be found under "Software".

3.1.7 Reset Button

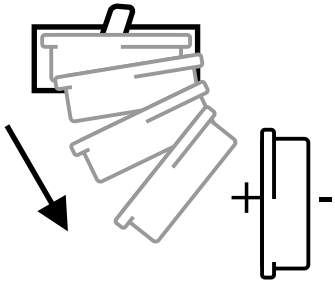
A hardware reset can be executed with this button. Different functions can be expected depending on the number set on the mode switch number dial (see description for mode switch number dial).

3.1.8 Contrast Setting

The contrast of the LCD display can be adjusted using a dial on the back of the unit (see "Component Overview").

3.1.9 Lithium Battery

The IP150 is equipped with a 3V/950mAh lithium battery for buffering data. It can be removed from the battery compartment by pulling the removal strip and then replaced with a new one (made sure the new battery is inserted over the removal strip). Replacement batteries can be ordered from B&R (see "Accessories").



Attention: Lithium batteries fall into the category of harmful waste and s

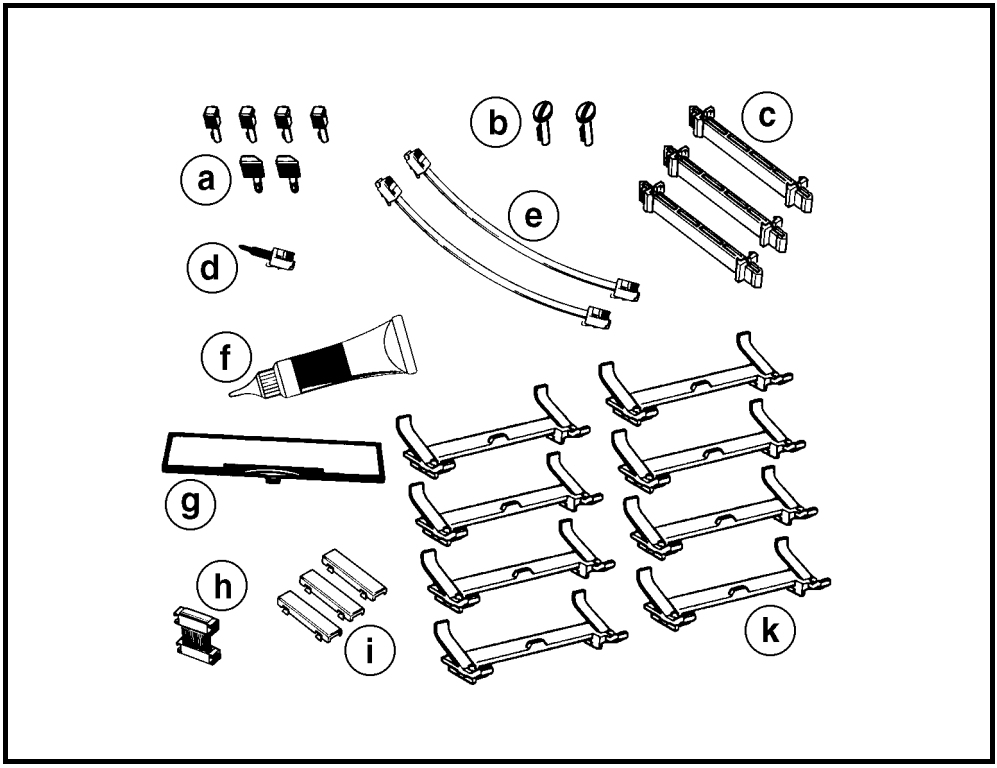
CHAPTER 7
ACCESSORIES

1 Accessories

This chapter describes the included accessories:

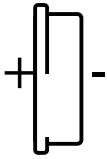
- Accessory Set
- Lithium Battery
- Label Sheets

1.1 Accessory Set



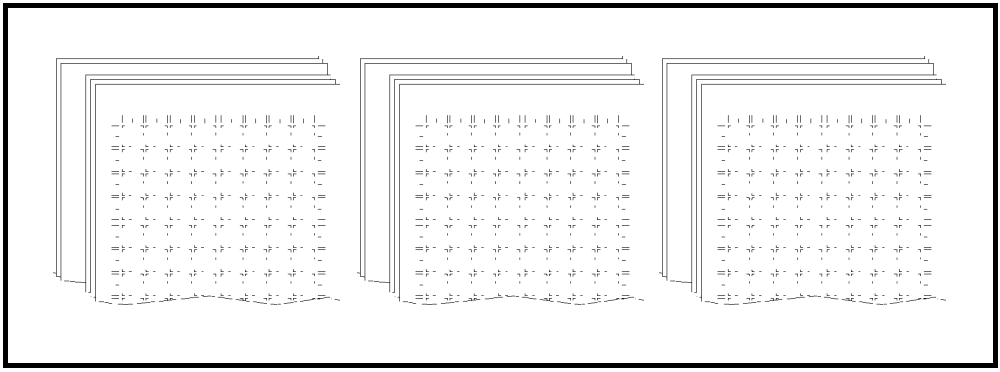
Contents	
a	1 Set of mounting pins
b	2 Mounting screws
c	3 Module Connectors
d	1 Termination resistor
e	2 Keyboard cable
f	1 Tube of sealant
g	1 Battery compartment cover
h	1 Ribbon cable
i	3 Cable covers
k	8 Spring clips
	1 PANELWARE assembly and installation guide

1.2 Lithium Battery



Lithium Battery for the C200 or C300
For installing or exchanging the lithium battery see chapter 2 *"Assembling Your System Components"*

1.3 Label Sheets



Labels for Keypad Modules
5 Label sheets for 4 key modules (A4 size)
5 Label sheets for 8 key modules (A4 size)
5 Label sheets for 16 or 12+4 key modules (A4 size)
5 Label sheets for 4 key modules (US Letter size)
5 Label sheets for 8 key modules (US Letter size)
5 Label sheets for 16 or 12+4 key modules (US Letter size)
Every sheet of labels consists of 6 module legend layouts for the respective module. These sheets are perforated for quick and easy access to new labels.

Label strips are also available for 4D1165 and 4D166 display panels.

1.4 Model Numbers

Accessories	Blue	Black
Accessory set	4A0007.00-000	4A0007.00-500
Lithium battery	4A0006.00-000	4A0006.00-500
Label sheets	4A0005.00-000	4A0005.00-500
Label sheets 1165 display panels (10 labels)	-	4A0021.00-000
Label sheets 1166 display panels (10 labels)	-	4A0023.00-000

CHAPTER 8
PRINTERS

1 Printers

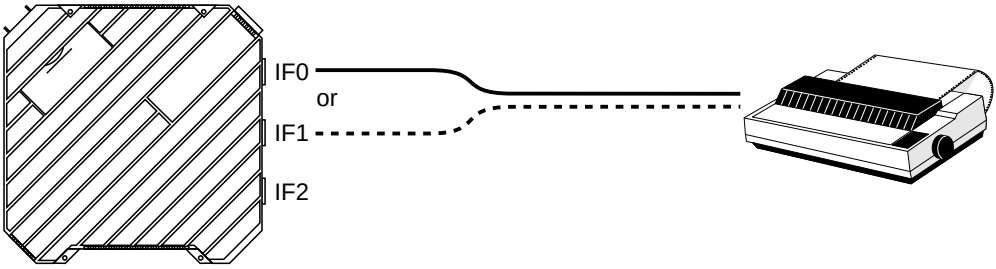
This chapter describes connections from the printer to the C200 or C300 panel controller.

- Printer ↔ Panel Controller
- Cabling Schematic

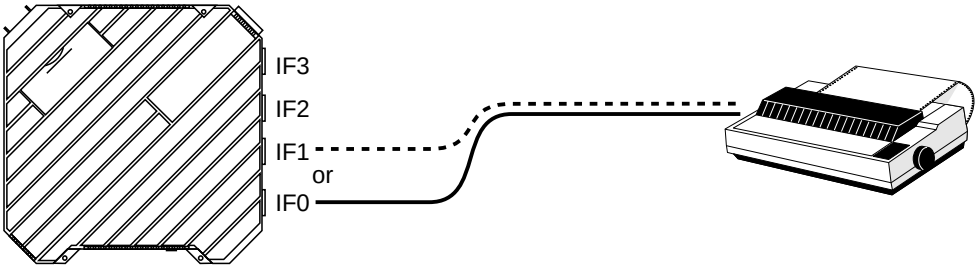
2 Printer ↔ Panel Controller

A printer can be connected to the IF0 or IF1 serial interface of the C200 and C300 panel controllers. The printer must be run through an RS232 interface.

2.1 Printer ↔ C200



2.2 Printer ↔ C300

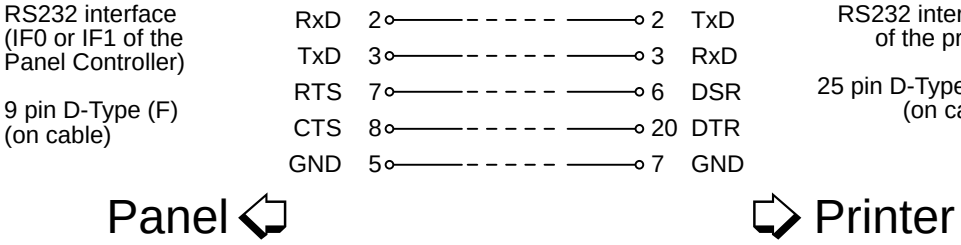


2.3 Interface Selection

Interface and baudrate, which should be used by the panel controller are to be selected on the PCS.

3 Cable Schematic

The serial printer cable can be connected to the IF0 or the IF1 interface on the panel controller:



CHAPTER 9
TROUBLE SHOOTING / DIAGNOSIS

1 Trouble Shooting / Diagnosis

This chapter should provide you wthl some help in finding and diagnosing errors.

- General Information
- Error Messages on Panel Displays with C100/C110
- Error Messages on the Display of a Panel with C200/C300
- Other Errors

2 General Information

Before a completed panel is finally built into a cabinet, a rack or a machine, it must be fully tested.

2.1 Visual Check

Before putting power to the unit, a thorough visual check is a must:

- ❒ All mechanical attachments must be checked for a good connection
- ❒ Is the ribbon cable correctly connected between the display module and the panel controller?
- ❒ **The cables between KeyPad modules are to be connected from the output of one to the input of another, otherwise you run the risk of module failure?**
- ❒ Is the termination resistor attached to the last KeyPad module?
- ❒ If necessary, check number switch settings.

2.2 Powering On for the First Time

The first test is run, in which the panel is connected with 24 V. In this case, the LEDs must be illuminated for a short period (module for module) and a message should appear on the display.

Only this point will be discussed in this chapter.

2.3 Starting an Application

In order to test a panel completely, an entire application can be started before the installation is finished, therefore ensuring the functionality of the modular unit.

3 Error Messages on Panel Displays with C100/C110

In order to first test a panel with the C100/C110 controller, the 24 V supply is connected to the designated connector. After a short period a status message appears on the display (this message is described in Appendix B under the command sequence *"Status Requests"*).

Keypad module is defect *Error-Code: f=1*[1]

- ❒ Is the termination resistor connected to the last module in the chain?
- ❒ Check keyboard cable connections:
  - Are all properly connected?
  - Are outputs connected with inputs only?
- ❒ Test individual keypad modules. Connect one module to the controller at a time (with termination resistor), in order to localise the defect module.

RAM is defect *Error-Code: g=1*[1]

Panel Controller is defect. It must be exchanged.

EPROM is defect *Error-Code: h=1*[1]

Panel Controller is defect. It must be exchanged.

[1)] See command sequence *"Status Request"* in Appendix B

4 Error Messages on Panel Displays with C200/C300

In order to first test a panel with a C200/C300 controller, the 24 V supply is connected to the designated connector. A message is displayed for a short time on the display (this message is described in Appendix B under command sequence *"Status Requests"*). This status message is overwritten however immediately by the following message or by the panel program.

"Keyboard error"

- ❒ Is the termination resistor attached on the last keypad module?
- ❒ Check the keyboard cable connection:
  - Is the connector in properly?
  - Connect outputs to inputs only!
- ❒ Test individual keypad modules, whereas only one module is connected to the controller at a time (with termination resistor!), in order to localise the defect module.

"No program"

A C200/C300 panel controller tries to start a user created panel program after a power-up (or reset). If no panel program exists, the "No program" message appears on the screen.

- ❒ Transfer a panel program from a PC (PCS).
  See *PANELWARE Software User's Manual* and *PANELWARE Application Manual*.

5 Other Errors

Display is dark

- ❒ Is the ribbon cable attached properly on the display module and on the panel controller?
- ❒ Is the power switched on?
- ❒ In order to localise the error, exchange the display module with one that is functioning properly:
  - If the replacement display is also dark, check the panel controller and its operating system.
  - If the status message is seen on the replacement display, the display is defect.

Display is illuminated, but no text is seen

- ❒ Is the ribbon cable attached correctly to the display module and to the panel controller?
- ❒ Check the panel controller and the operating system.

LEDs do not light on the Keypad module

After power-on (or a reset) the LEDs on the Keypad modules must light for a short period of time (module for module).

- ❒ Is the termination resistor attached on the last keypad module?
- ❒ Check the keyboard cable connections:
  - Is it connected properly?
  - Connect outputs with inputs only!
- ❒ Test individual modules, whereas only one module is connected with the panel controller at a time (with termination resistor), in order to localise the defect module.

Cannot make connection with PC

The C200/C300 panel controller must be connected through interface IF0 with the PC on which the PCS program (PANELWARE Configuration Software) is installed. If no panel program can be transferred to or from the panel, the following points should be checked:

- ❒ Is the operating mode set correctly on the panel controller (*Teach Mode*)?
- ❒ Is the proper cable connected and is it connected properly and in good shape?
- ❒ Is the cable connected to interface IF0 of the panel controller?
- ❒ Is the proper PC interface defined for communication in the PCS?

APPENDIX A
CABLING (PC CONNECTION)

1 Cabling Information (PC Connection)

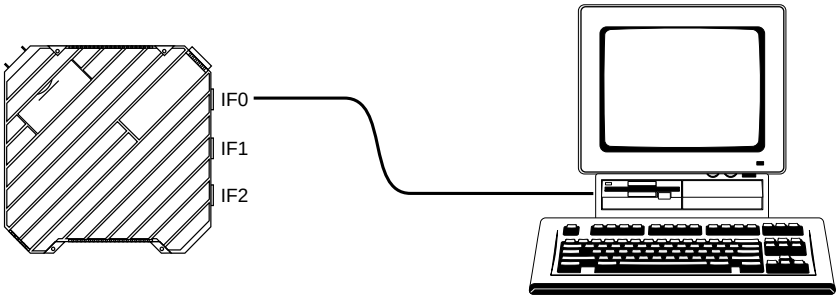
This appendix explains the connection cabling between the panel controller and the PC.

- Panel Controller C200 or C300 ↔ PC (PCS)
- Cabling Schematic

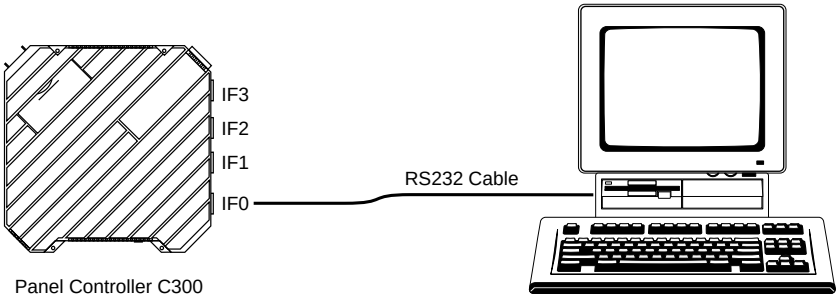
2 Panel Controller C200 or C300 ↔ PC

Connecting panel controller C200 or C300 with the PC is done over a serial interface. The IF0 interface of a panel controller is connected with a cable to the RS232 interface of the PC (COM1 or COM2).

2.1 C200 ↔ PC



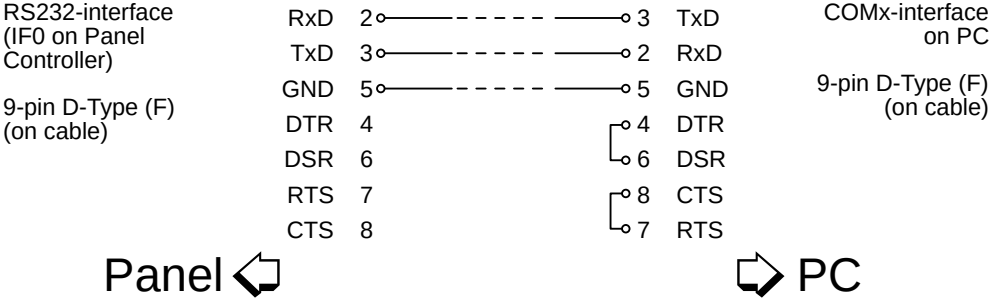
2.2 C300 ↔ PC



3 Cable Schematic

The serial cable between the panell controller and the PC can be ordered with the following model numbers:

Description	Model Number
RS232-Cable	0G0009.00-090



If the PC has a 25 pin connnector instead of a 9 pin D-type male serial interface, an adapter is necessary.

APPENDIX B
VT100 COMMAND SET FOR PANEL CONTROLLERS C100, C110 AND C130

1 VT100 Command Set for Panel Controllers C100, C110 and C130

This appendix is a description of the communication between the PLC and the C100 Panel Controller.

- General Information
  - Data Transfer Panel - PLC
  - Data Transfer PLC - Panel
  - Command Sequences
  - Syntax
- Key Codes
- Key Modes
  - WAIT-REPEAT-Mode
  - REPEAT-Mode
  - SINGLE-Mode
  - TOGGLE-Mode
  - t_{off} Code Suppression
- Key Commands
- LED Commands
- Cursor Commands
- Write and Delete Commands
- Graphic Commands
- Miscellaneous Commands
- C130 Commands
- Error Messages
- Error Correction

2 General Information

Communication between the PLC and the C100 is bi-directional, whereas the handshake can be picked out by the user by means of a number switch.

2.1 Data Transfer Panel ⇨ PLC

Data information, which the B&R operator panel sends to a PLC, is generally 1 byte long. The data transferred either consists of key codes or (error) messages. The format that the key codes is sent in can be defined through control sequences from the PLC.
In addition, the PLC make request the panel to, ...

1. Send a status string, which contains information on the panel configuration.
2. Send the contents of the display memory to the PLC.

The formats (of key codes, status strings or display contents), which are sent from the panel are described with the respective commands.

2.2 Data Transfer PLC ⇨ Panel

Data (commands), which can be sent from the PLC to the C100 panel controller correspond to an expanded VT100 command set.

2.3 Command Sequences

Most commands consist of sequences which are constructed as follows:

1. Control characters
2. Character, that the command specifies
3. Possible parameter

Either the ASCII character <ESC> (dec.: 27, hex.: 1B) or <CSI> (dec.: 155, hex.: 9B) is used as a control character. The panel first begins executing the command, if the number of parameters to be given is complete.
The control character <CSI> can be replaced by the character sequence <ESC> <[>.
All control sequences can be interrupted every time that the PLC sends <ESC>. In this case the panel responds with error code hex. $97 (command sequence aborted).

2.4 Syntax

For the description of commands and control sequences the following syntax is used:

<x> ..... Characters within triangular brackets represent the character is the ASCII table:

Alphanumeric character:	<a>, <A>, <0>, <9>, ...
Other character:	<!>, <#>, <ß>, ...
Control character:	<BS>, <CR>, <ESC>, ...

xxx ..... Numerical values, which are not in brackets are to be interpreted as decimal ASCII values.

<??> ..... Values, which depend on the connected display module.

(x) ..... Parameter for the respective command.

3 Key Codes

According to the mode which is set, two different codes are sent to the PLC for each key (t_{on} and t_{off} code). A maximum of 7 keypad modules, each with max. 16 keys can be connected to a panel controller. By pressing a key the respective key code is sent:

Keypad Module 1

32	36	40	44
33	37	41	45
34	38	42	46
35	39	43	47

Keypad Module 2

48	52	56	60
49	53	57	61
50	54	58	62
51	55	59	63

Keypad Module 3

64	68	72	76
65	69	73	77
66	70	74	78
67	71	75	79

Keypad Module 4

80	84	88	92
81	85	89	93
82	86	90	94
83	87	91	95

Keypad Module 5

96	100	104	108
97	101	105	109
98	102	106	110
99	103	107	111

Keypad Module 6

112	116	120	124
113	117	121	125
114	118	122	126
115	119	123	127

Keypad Module 7

0	4	8	12
1	5	9	13
2	6	10	14
3	7	11	15

In these tables, the t_{on} code is given. The t_{off} code is calculated from this formula:
$t_{off} = t_{on} + 128$

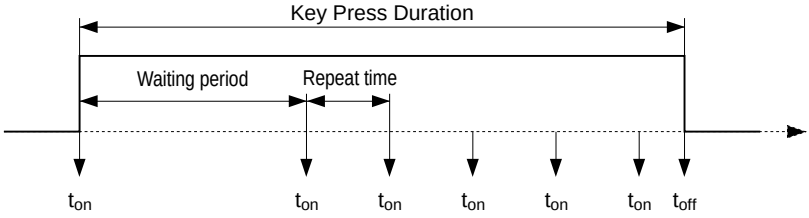
The numbering (keypad modules 1 to 7) depends on the cabling and is respective of the connection sequence on the panel controller. The keypad module, which is connected directly to the panel controller has number 1. For each module there are 16 t_{on} and 16 t_{off} codes reserved. Keypad modules with fewer keys only use some of those codes. The codes correspond with the layout of the keys on the module; a module with four keys only uses the rightmost column of the module.

4 Key Modes

Every single key can be assigned with a key mode by means of control sequences, whereas four possibilities exist:

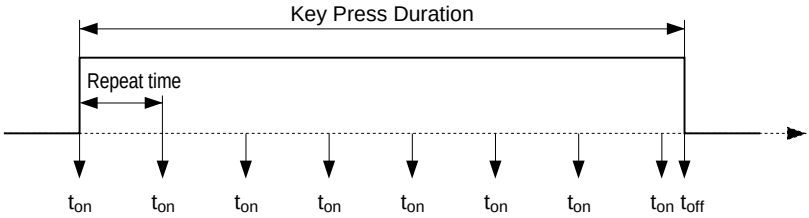
4.1 WAIT-REPEAT Mode

When a key is pressed, the t_{on} code of the key is sent once. After a defined waiting period the t_{on} code (with definable repeat frequency) is sent continuously until the key is released at which time the t_{off} code (t_{on} + 128) is sent.



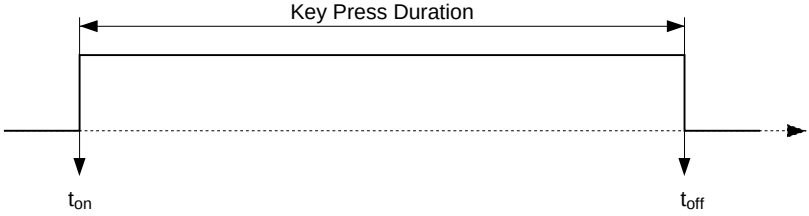
4.2 REPEAT Mode

By pressing a key, the t_{on} code is sent one time. The t_{on} code (with definable repeat frequency) is then sent continuously until the key is released. The t_{off} code is then sent.



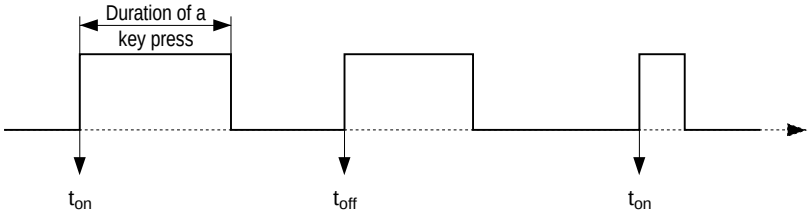
4.3 SINGLE Mode

The t_{on} code is sent at the beginning of the key press and the t_{off} code at the end.



4.4 TOGGLE Mode

At the beginning of a key press either the t_{on} or the t_{off} code is sent. Releasing the key has no effect.



4.5 Suppression of t_{off} codes

With a command from the PLC, the panel controller can suppress either one or all t_{off} codes, i.e. only t_{on} codes are sent to the PLC.

5 Key Commands

KEY MODE SETTING

Description: This command is used to define the key mode of one or of all keys.

Command:

Syntax	<ESC>	<T>	(Nr)	(M)
hexadec.	1B	54	(Nr)	(M)
dec.	27	84	(Nr)	(M)

Parameter: **(Nr) .....** Key number

(Nr)	Description
31	All keys are configured with the given mode (M).
0 - 15 32 - 127	The key (Nr) is configured with the given mode (M).

(M) ..... Mode

(M)	Description
<w>	WAIT-REPEAT
<r>	REPEAT
<s>	SINGLE
<t>	TOGGLE

Default: After a RESET or Power-On, SINGLE mode is set for all keys.

See also:
- Waiting time definition
- Repeat frequency definition

WAITING TIME DEFINITION

Description: With this command the waiting time for **all** keys which are operating in WAIT-REPEAT mode are defined.

Command:

Syntax	<ESC>	<w>	(w)	
hexadec.	1B	77	(w1)	(w0)
dec.	27	119	(w1)	(w0)

Parameter: **(w) .....** Waiting time is tenths of a second may lie within the following range:

(w) = <0><1> .... **<5><0>**

Default: After a RESET or Power-On, the waiting time is set to 1 sec (<1><0>) as a default.

See also:
- Key mode setting
- Repeat frequency definition

REPEAT FREQUENCY DEFINITION

Description: With this command, the repeat frequency is defined for all keys, which are operating in WAIT-REPEAT or REPEAT mode.

Command:

Syntax	<ESC>	<f>	(f)	
hexadec.	1B	66	(f1)	(f0)
dec.	27	102	(f1)	(f0)

Parameter: (f) ..... Repeat frequency in hertz may lie within the following range:

(f) = <0><1> .... **<2><5>**

Default: After a RESET or Power-On, the repeat time is repeat frequency set to 10 Hz (<1><0>) as default.

See also: Key mode setting

T_{OFF} CODES ON/OFF

Description: With this command, the transmission of t_{off} codes is suppressed for every key mode and for every key.

Command:

Syntax	<ESC>	<n>	(Nr)	(s)
hexadec.	1B	6E	(Nr)	(s)
dec.	27	110	(Nr)	(s)

Parameter: **(Nr) .....** Key number

(Nr)	Description
31	The t_{off} codes of all keys are switched on or off.
0 - 15 32 - 127	The t_{off} code of the given key (Nr) is switched on or off.

(s) ..... Switch

(s)	Description
<Y>	YES: Send t_{off} codes
<N>	NO: Suppress t_{off} codes

Default: After a RESET or Power-On, the t_{off} code is sent for all keys.

6 LED Commands

Note:

For technical reasons, it is not possible to switch on more than 48 LEDs simultaneously. The amount of active LEDs (On, Blinking slowly or Blinking quickly) is monitored by the panel. If 48 LEDs are already active, all other commands to activate LEDs are ignored.

With the "All LEDs On/Blinking" command, the LEDs are switched on beginning with the first in the row, until 48 LEDs are active. In this case the operating system takes for granted that every keypad module is equipped with 16 LEDs. Therefore, it is possible that less than 48 LEDs are activated since not all keypad module is equipped with 16 LEDs.

LED ON

Description: With this command, single LEDs or all LEDs can be switched on. Additionally, the *Local Echo* of the selected LED(s) is switched off.

Command:

Syntax	**<ESC>**	**<e>**	**(Nr)**
hexadec.	**1B**	**65**	**(Nr)**
dec.	**27**	**101**	**(Nr)**

Parameter: **(Nr) .....** LED-Number (identical with key number)

(Nr)	Description
31	"All" LEDs are switched on as described above. The *Local Echo* for all LEDs is switched off.
0 - 15 32 - 127	The selected LED (Nr) is switched on and the *Local Echo* is switched off.
20 - 26	"All" LEDs on the selected keypad module are switched on and the *Local Echo* is switched off. 20..... Keypad 1 21..... Keypad 2 22..... Keypad 3 23..... Keypad 4 24..... Keypad 5 25..... Keypad 6 26..... Keypad 7

LED SLOWLY BLINKING

Description: This causes individual key LEDs or all LEDs to blink slowly (1 Hz). In addition the *Local Echo* of the selected LED(s) is switched off.

Command:

Syntax	<ESC>	<l>	(Nr)
hexadec.	1B	6C	(Nr)
dec.	27	108	(Nr)

Parameter: **(Nr) .....** LED-Number (identical with key number)

(Nr)	Description
31	Slowly blinking is switched on for "all" LEDs as described previously (see *note on page 10*). The *Local Echo* is switched off for all LEDs.
0 - 15 32 - 127	Slowly blinking is switched on for the selected LED (Nr) and the *Local Echo* is switched off.
20 - 26	Slowly blinking is switched on for "all" LEDs on the selected keypad module and the *Local Echo* is switched off. 20.....Keypad 1 21 ..... Keypad 2 22.....Keypad 3 23 ..... Keypad 4 24.....Keypad 5 25 ..... Keypad 6 26.....Keypad 7

LED QUICKLY BLINKING

Description: With this command the quickly blinking (5 Hz) for individual or for all LEDs is switched on. In addition, the *Local Echo* for the selected LED(s) is switched off.

Command:

Syntax	**<ESC>**	**<s>**	**(Nr)**
hexadec.	**1B**	**73**	**(Nr)**
dec.	**27**	**115**	**(Nr)**

Parameter: **(Nr) .....** LED-Number (identical to key number)

(Nr)	Description
31	Quickly blinking is switched on for "all" LEDs as described previously (see *note on page 10*). The *Local Echo* is switched off for all LEDs.
0 - 15 32 - 127	Quickly blinking is switched on for the selected LED (Nr) and the *Local Echo* is switched off.
20 - 26	Quickly blinking is switched on for "all" LEDs on the selected keypad module and the *Local Echo* is switched off. 20..... Keypad 1 21..... Keypad 2 22..... Keypad 3 23..... Keypad 4 24..... Keypad 5 25..... Keypad 6 26..... Keypad 7

LED OFF

Description: With this command, either individual or all LEDs can be switched off. The *Local Echo* is also switched off for the selected LED(s).

Command:

Syntax	<ESC>	<a>	(Nr)
hexadec.	1B	61	(Nr)
dec.	27	97	(Nr)

Parameter: **(Nr) .....** LED-Number (identical to key number)

(Nr)	Description
31	"All" LEDs are switched off. The *Local Echo* is switched off for all LEDs.
0 - 15 32 - 127	The selected LED (Nr) is switched off and the *Local Echo* is switched off for that LED.
20 - 26	"All" LEDs on the selected keypad module are switched off and the *Local Echo* is switched off. 20.....Keypad 1 21 ..... Keypad 2 22.....Keypad 3 23 ..... Keypad 4 24.....Keypad 5 25 ..... Keypad 6 26.....Keypad 7

LOCAL ECHO ON

Description: With this command the *Local Echo* is switched on for individual LEDs or for all LEDs. *Local Echo* means that each key press causes the respective LED to be simultaneously activated with the attribute set for the LED (i.e. slowly blinking, quickly blinking etc.) for as long as the key is pressed. Releasing the key switches the LED off. This provides the user with an optical signal when pressing a key without putting additional load on the PLC because this is all done within the panel.

Command:

Syntax	<ESC>	<H>	(Nr)	(Att)
hexadec.	1B	48	(Nr)	(Att)
dec.	27	72	(Nr)	(Att)

Parameter: **(Nr) .....** LED-Number (identical to key number)

(Nr)	Description
31	The *Local Echo* for all LEDs is switched on
0 - 15 32 - 127	The *Local Echo* of the selected LED is switched .
20 - 26	The *Local Echo* "all" LEDs on the selected keypad module are switched on. 20 ..... Keypad 1 21 ..... Keypad 2 22 ..... Keypad 3 23 ..... Keypad 4 24 ..... Keypad 5 25 ..... Keypad 6 26 ..... Keypad 7

(Att) ..... Attribute

(Att)	Description
<d>	LED continuously lit
<s>	LED blinks quickly (5 Hz)
<l>	LED blinks slowly (1 Hz)

Default: After a RESET or Power-On the *Local Echo* is switched off for all keys.

7 Cursor Commands

Cursor Left

Description: The cursor is moved one position to the left. If the cursor is found in the first column, this command is ignored.

Command:

Syntax	<CSI>	<D>
hexadec.	9B	44
dec.	155	68

Cursor Right

Description: The cursor moves one position to the right. If the cursor is already in the last column, the command is ignored.

Command:

Syntax	<CSI>	<C>
hexadec.	9B	43
dec.	155	67

Cursor Up

Description: The cursor moves one position (line) upward. If the cursor is found in the top line, the command is ignored.

Command:

Syntax	<CSI>	<A>
hexadec.	9B	41
dec.	155	65

Cursor Down

Description: The cursor moves one position (line) downward. If the cursor is found in the bottom line, the command is ignored.

Command:

Syntax	<CSI>	<B>
hexadec.	9B	42
dec.	155	66

CURSOR HOME

Description: The cursor is placed in the first position of the first line.

Command:

Syntax	<CSI>	<H>
hexadec.	9B	48
dec.	155	72

or:

Syntax	<CSI>	<f>
hexadec.	9B	66
dec.	155	102

CURSOR TO END

Description: The cursor is placed in the last position of the last line.

Command:

Syntax	<CSI>	<E>
hexadec.	9B	45
dec.	155	69

CURSOR POSITIONING

Description: The cursor is placed in the given position. A disallowed position (outside of the display) causes the command to be ignored.

Command:

Syntax	<CSI>	(z)		<;>	(s)		<H>
hexadec.	9B	(z1)	(z0)	3B	(s1)	(s0)	48
dec.	155	(z1)	(z0)	59	(s1)	(s0)	72

or:

Syntax	<CSI>	(z)		<;>	(s)		<f>
hexadec.	9B	(z1)	(z0)	3B	(s1)	(s0)	66
dec.	155	(z1)	(z0)	59	(s1)	(s0)	102

Parameter: **(z) .....** Line number (beginning with **<0><1>**)
(s) ..... Column number (beginning with **<0><1>**)

CARRIAGE RETURN

Description: The cursor is moved to the first position of the current line.

Command:

Syntax	<CR>
hexadec.	0D
dec.	13

LINE FEED

Description: The cursor is moved to the same position in the next line down. If the cursor is already in the last line, the entire screen moves one line up. At the bottom of the screen a blank line appears and the line at the top of the screen is lost.

Command:

Syntax	<LF>
hexadec.	0A
dec.	10

CURSOR ON

Command: The cursor position is shown by means of an underscore.

Command:

Syntax	<CSI>	<h>
hexadec.	9B	68
dec.	155	104

or:

Syntax	<CSI>	<?>	<2>	<5>	<h>
hexadec.	9B	3F	32	35	68
dec.	155	63	50	53	104

Default: This type of cursor display is set with every reset or power-on.

CURSOR OFF

Description: The cursor is switched off. The cursor position is no longer shown.

Command:

Syntax	<CSI>	<l>
hexadec.	9B	6C
dec.	155	108

or:

Syntax	<CSI>	<?>	<2>	<5>	<l>
hexadec.	9B	3F	32	35	6C
dec.	155	63	50	53	108

CURSOR BLINKING

Description: The cursor position is shown with a blinking character or a blinking bar (switched between non-inverse and inverse display).

Command:

Syntax	<CSI>	<b>
hexadec.	9B	62
dec.	155	98

or:

Syntax	<CSI>	<?>	<2>	<5>	<b>
hexadec.	9B	3F	32	35	62
dec.	155	63	50	53	98

CHANGE CURSOR SHAPE

Description: For displays which support this, the cursor shape is changed and with displays which do not support this function it has been converted to the “Cursor Blinking” command.

Command:

Syntax	<CSI>	<v>
hexadec.	9B	76
dec.	155	118

or:

Syntax	<CSI>	<?>	<2>	<5>	<v>
hexadec.	9B	3F	32	35	76
dec.	155	63	50	53	118

8 Write and Delete Commands

Write Character

Description: If a displayable ASCII character (ASCII-Nr. 32 -126, 128 - 154 and 156 - 255 in the expanded character set) is received from the panel, it is immediately displayed on the screen in the current cursor position and the cursor forward is made one position to the right. The old character is overwritten. If the cursor was in the last position of the line, the cursor remains unchanged.

Command:

Syntax	(z)
hexadec.	(z)
dec.	(z)

Insert Character

Description: A blank space is made in the cursor position and all characters starting from the cursor position are moved one position to the right. The character that was originally the last character in the line is pushed off the screen and deleted. The cursor position remains the same.

Command:

Syntax	<CSI>	<e>
hexadec.	9B	65
dec.	155	101

Delete Character

Description: The character in the actual cursor position is deleted. The character to the right of the cursor is moved one position to the left. All other characters in the line move to the left as well causing a blank space where the last character in the line was. The cursor position remains unchanged.

Command:

Syntax	<DEL>
hexadec.	7F
dec.	127

or:

Syntax	<CSI>	<P>
hexadec.	9B	50
dec.	155	80

DELETE CHARACTER WITHOUT BACKSPACE

Description: The character in the actual cursor position is deleted. The position of the cursor remains unchanged.

Command:

Syntax	<CSI>	<X>
hexadec.	9B	58
dec.	155	88

BACKSPACE

Description: The character to the left of the cursor is deleted and the cursor moves one position to the left. All characters to the right of the cursor position move one character to the left to fill the deleted character position. The old position of the last character in the line is replaced by a blank character. If the cursor is in the first position of a line, the command is ignored.

Command:

Syntax	<BS>
hexadec.	08
dec.	8

INSERT LINE

Description: All lines under and including the line that the cursor is in are moved down one line. The line that was originally at the bottom is moved off of the screen and deleted. A blank line is inserted in the cursor position. The position of the cursor remains unchanged.

Command:

Syntax	<CSI>	<L>
hexadec.	9B	4C
dec.	155	76

DELETE LINE

Description: The entire line in which the cursor is found is deleted. All lines under the line holding the cursor are moved up one line. In the position of the last line a blank line is inserted. The cursor position remains unchanged.

Command:

Syntax	<CSI>	<M>
hexadec.	9B	4D
dec.	155	77

DELETE FROM CURSOR TO LINE END

Description: The characters in and to the right of the cursor position are deleted until the end of the line. The cursor position remains unchanged.

Command:

Syntax	<CSI>	<K>
hexadec.	9B	4B
dec.	155	75

CLEAR SCREEN

Description: The entire display is deleted and the cursor is placed in home position.

Command:

Syntax	<CSI>	<2>	<J>
hexadec.	9B	32	4A
dec.	155	50	74

BLINK MODE ON

Description: All displayable characters are output with the **blinking** attribute. This command is active until the "All Attributes Off" command is given.

Command:

Syntax	<CSI>	<5>	<m>
hexadec.	9B	35	6D
dec.	155	53	109

See also:
- All Attributes Off
- Inverse Mode On

ALL ATTRIBUTES OFF

Description: The attributes of any further characters to be output are switched off, i.e., **blinking** as well as **inverse** is deactivated.

Command:

Syntax	<CSI>	<0>	<m>
hexadec.	9B	30	6D
dec.	155	48	109

See also:
- Blinking Mode On
- Inverse Mode On

INVERSE MODE ON

Description: The characters to follow are displayed inversely.

Command:

Syntax	<CSI>	<7>	<m>
hexadec.	9B	37	6D
dec.	155	55	109

See also:
- Blinking Mode On
- All Attributes Off

DISPLAY X CHARACTERS BLINKING

Description: Starting from the given cursor position line (z) and column (s) the **blinking** attribute is switched on for (x) amount of characters. The amount of lines displayed on the screen can also be exceeded.

Command:

Syntax	<ESC>	<N>	(z)		(s)		(x)	
hexadec.	1B	4E	(z1)	(z0)	(s1)	(s0)	(x1)	(x0)
dec.	27	78	(z1)	(z0)	(s1)	(s0)	(x1)	(x0)

Parameter: (z) ..... Line number
Range: <0><1> to <?><?> (depending on display size)
(s) ..... Column number
Range: <0><1> to <?><?> (depending on display size)
(x) ..... Number of characters which should be displayed with the **blinking** attribute.
Value: <?><?>

See also:
- Display X Characters Normally
- Display X Characters Inversely

DISPLAY X CHARACTERS NORMALLY

Description: Starting from the given cursor position line (z) and column (s), attributes **blinking** and **inverse** are switched off for (x) amount of characters. The amount of lines displayed on the screen can also be exceeded.

Command:

Syntax	<ESC>	<Q>	(z)		(s)		(x)	
hexadec.	1B	51	(z1)	(z0)	(s1)	(s0)	(x1)	(x0)
dec.	27	81	(z1)	(z0)	(s1)	(s0)	(x1)	(x0)

Parameter: (z) ..... Line number
Range: <0><1> to <?><?> (depending on display size)
(s) ..... Column number
Range: <0><1> to <?><?> (depending on display size)
(x) ..... Number of characters which should be displayed with attributes **blinking** and **inverse** switched off.
Value: <?><?>

See also:
- Display X Characters Blinking
- Display X Characters Inversely

Display X Characters Inversely

Description: Starting from the given cursor position line (z) and column (s), the **blinking** attribute is switched on for (x) amount of characters. The amount of lines displayed on the screen can also be exceeded.

Command:

Syntax	<ESC>	<O>	(z)		(s)		(x)	
hexadec.	1B	4F	(z1)	(z0)	(s1)	(s0)	(x1)	(x0)
dec.	27	79	(z1)	(z0)	(s1)	(s0)	(x1)	(x0)

Parameter: (z) ..... Line number
Range: <0><1> to <?><?> (depending on display size)
(s) ..... Column number
Range: <0><1> to <?><?> (depending on display size)
(x) ..... Number of characters which should be displayed with the **inverse** attribute switched on.
Value: <?><?>

See also:
- Display X Characters Blinking
- Display X Characters Normally

*1*1 Character Size*

Description: All following characters are displayed in the standard size one the screen. This command only applies to graphic panels, otherwise it is ignored.

Command:

Syntax	<ESC>	<#>	<1>
hexadec.	1B	23	31
dec.	27	35	49

*2*2 Character Size*

Description: All following characters are displayed in double the standard size. This command only applies to graphic panels, otherwise it is ignored.

Command:

Syntax	<ESC>	<#>	<2>
hexadec.	1B	23	32
dec.	27	35	50

4*4 Character Size

Description: All following characters are displayed in four times the original standard size. This command only applies to graphic panels, otherwise it is ignored.

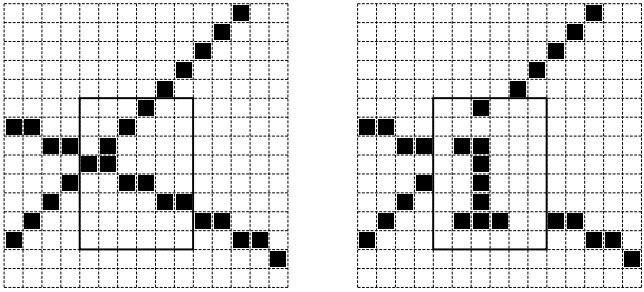
Command:

Syntax	<ESC>	<#>	<4>
hexadec.	1B	23	34
dec.	27	35	52

9 Graphic Commands

Graphic commands only apply to graphic panels. Graphic elements are displayed without regard to anything already on the display. If a character is output in the same position as a part of the graphic, that position is cleared and the pixel pattern of the character is displayed. A standard size character is 8 pixels high and 6 pixels wide (with an 8 X 40 display). Therefore, when a character is output in a position that is occupied by part of a line, the line will be broken.

Example:



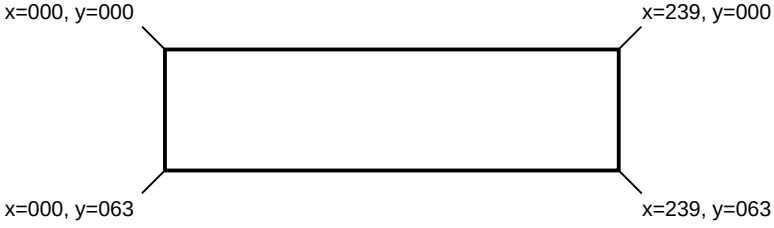
Graphic commands begin with code <ESC> <G>, if the object should be drawn and with code <ESC> <C>, if the object should be deleted.

The position of the graphic element is defined through a (x/y) co-ordinate pair:

x ..... Horizontal coordinate
y ..... Vertical coordinate

The top left co-ordinate point has co-ordinates x=0 and y=0.

If using an 8*40 Graphic display:



Parameters for the co-ordinates are three places and coded in ASCII (each co-ordinate consists of three bytes). The respective maximum values depend on the size of the display.

The following shorts are used in the graphic commands:

(xxx) ..... X-co-ordinate of the upper left-hand corner of the object.
(yyy) ..... Y-co-ordinate of the upper left-hand corner of the object.
(bbb) ..... Width of bar vertical to the direction of extension. Width of a rectangle always in the X direction (horizontal).
(hhh) ..... Height of a rectangle always in Y direction (vertical).
(fff) ..... Fill degree of a bar (Number of active pixels).
(lll) ..... Length of a line or bar.
(sss) ..... Width of a rectangle.

All co-ordinates and parameters are monitored in order to ensure that the entire object has room on the display. Should the object be outside of the display, in whole or in part, it is not drawn and error message ($97) is sent.

SET/DELETE POINT

Description: The pixel in the selected position is either set or deleted.

Command:

Syntax	<ESC>	<G/C>	<p>	(xxx)			(yyy)		
hexadec.	1B	47/43	70	(x2)	(x1)	(x0)	(y2)	(y1)	(y0)
dec.	27	71/67	112	(x2)	(x1)	(x0)	(y2)	(y1)	(y0)

Parameter: **(xxx) .....** X-co-ordinate of the point
(yyy) ..... Y-co-ordinate of the point

DRAW/DELETE HORIZONTAL LINE

Description: A horizontal line is either drawn or deleted with the given length from pixel position (x/y).

Command:

Syntax	<ESC>	<G/C>	<h>	(xxx)			(yyy)			(lll)		
hexadec.	1B	47/43	68	(x2)	(x1)	(x0)	(y2)	(y1)	(y0)	(l2)	(l1)	(l0)
dec.	27	71/67	104	(x2)	(x1)	(x0)	(y2)	(y1)	(y0)	(l2)	(l1)	(l0)

Parameter: **(xxx) .....** X-co-ordinate of the left-hand point of the line
(yyy) ..... Y-co-ordinate of the left-hand point of the line
(lll) ..... Length of the line in pixels

DRAW/DELETE VERTICAL LINE

Description: A vertical line is either drawn or deleted with the given length from pixel position (x/y).

Command:

Syntax	<ESC>	<G/C>	<v>	(xxx)			(yyy)			(lll)		
hexadec.	1B	47/43	76	(x2)	(x1)	(x0)	(y2)	(y1)	(y0)	(l2)	(l1)	(l0)
dec.	27	71/67	118	(x2)	(x1)	(x0)	(y2)	(y1)	(y0)	(l2)	(l1)	(l0)

Parameter: **(xxx) .....** X-co-ordinate of the upper point of the line
(yyy) ..... Y-co-ordinate of the upper point of the line
(lll) ..... Length of the line in pixels

DRAW/DELETE BORDER

Description: From pixel position (x/y), a rectangle is drawn or deleted using the given sizes width, height and line thickness.

Command:

Syntax	<ESC>	<G/C>	<f>	(xxx)			(yyy)			(bbb)		
hexadec.	1B	47/43	66	(x2)	(x1)	(x0)	(y2)	(y1)	(y0)	(b2)	(b1)	(b0)
dec.	27	71/67	102	(x2)	(x1)	(x0)	(y2)	(y1)	(y0)	(b2)	(b1)	(b0)

(hhh)			(sss)		
(h2)	(h1)	(h0)	(s2)	(s1)	(s0)
(h2)	(h1)	(h0)	(s2)	(s1)	(s0)

Parameter: **(xxx) .....** X-co-ordinate of the upper left corner point of the border
(yyy) ..... Y-co-ordinate of the upper left corner point of the border
(bbb) ..... Width of the border (horizontal) in pixels
(hhh) ..... Height of the border (vertical) in pixels
(sss) ..... Line thickness of the border in pixels

DRAW/DELETE RECTANGLE

Description: From pixel position (x/y), a filled rectangle is drawn or deleted using the given sizes width, height and line thickness.

Command:

Syntax	<ESC>	<G/C>	<r>	(xxx)			(yyy)			(bbb)		
hexadec.	1B	47/43	72	(x2)	(x1)	(x0)	(y2)	(y1)	(y0)	(b2)	(b1)	(b0)
dec.	27	71/67	114	(x2)	(x1)	(x0)	(y2)	(y1)	(y0)	(b2)	(b1)	(b0)

(hhh)		
(h2)	(h1)	(h0)
(h2)	(h1)	(h0)

Parameter:
(xxx) ..... X-co-ordinate of the upper left corner point of the rectangle
(yyy) ..... Y-co-ordinate of the upper left corner point of the rectangle
(bbb) ..... Width of the rectangle (horizontal) in pixels
(hhh) ..... Height of the rectangle (vertical) in pixels

ANIMATED BAR

Description: A bar (rectangular shape), with the direction of extension corresponding with the defined bar type is either drawn or deleted. The width of the rectangular shape is always referred to as perpendicular to the direction of extension whereas the length is the maximum extension. According to the fill degree, the bar is filled in black and the rest is not drawn (white).

Command:

Draw bar:

Syntax	<ESC>	<G>	<b>	(xxx)			(yyy)			(bbb)		
hexadec.	1B	47	(b)	(x2)	(x1)	(x0)	(y2)	(y1)	(y0)	(b2)	(b1)	(b0)
dec.	27	71	(b)	(x2)	(x1)	(x0)	(y2)	(y1)	(y0)	(b2)	(b1)	(b0)

(lll)			(fff)		
(l2)	(l1)	(l0)	(f2)	(f1)	(f0)
(l2)	(l1)	(l0)	(f2)	(f1)	(f0)

Delete bar:

Syntax	<ESC>	<C>	<b>	(xxx)			(yyy)			(bbb)		
hexadec.	1B	43	(b)	(x2)	(x1)	(x0)	(y2)	(y1)	(y0)	(b2)	(b1)	(b0)
dec.	27	67	(b)	(x2)	(x1)	(x0)	(y2)	(y1)	(y0)	(b2)	(b1)	(b0)

(lll)		
(l2)	(l1)	(l0)
(l2)	(l1)	(l0)

Parameter: **(b) .....** Bar type

(b)	Description
<e>	Bar fills from left to right. The lower left-hand corner is used as reference point (x/y).
<w>	Bar fills from right to left. The lower right-hand corner is used as reference point (x/y).
<n>	Bar fills from bottom to top with the lower left-hand corner as a reference point (x/y).
<s>	Bar fills from top to bottom with the top right-hand corner as reference point (x/y).

(xxx) ..... X-co-ordinate of the reference point

(yyy) ..... Y-co-ordinate of the reference point

(bbb) ..... Width of the bar in pixels. The given value refers to the perpendicular of the direction of extension of the bar.

(lll) ..... Length of the bar in pixels. The given value represents the maximum extension of the bar.

(fff) ..... Fill degree of the bar in pixels. This value may not lie outside of the range $0 \leq (fff) \leq (hhh)$.

TREND SEGMENT

Description: A trend segment is drawn with this function. A trend segment has a rectangular shape. The size of the rectangle is defined by the width (extension in the X direction) and the height (extension in the Y direction). The position (x/y) is defined by the upper left-hand corner point of the rectangle. A line is drawn in this rectangle, whereas value 1 describes the Y position on the left border and value 2 describes the Y position on the right border. Since value 0 must also be displayed, value 1 and value 2 have a value range 0 to (height - 1). The rectangle itself, is not drawn. The background (of the entire triangle) can optionally be deleted before the trend segment is drawn, otherwise the line is drawn on the existing background. Co-ordinate lines can also be displayed (upper, center, lower). This facilitates a viewable trend having positive, negative or positive and negative values. Another option permits filling the rectangle under the trend curve. An explicit delete command does not exist, since the entire trend or even a segment of it can easily be deleted by means of the rectangle commands.

Command:

Syntax	<ESC>	<G>	<t>	(xxx)			(yyy)			(bbb)		
hexadec.	1B	47	74	(x2)	(x1)	(x0)	(y2)	(y1)	(y0)	(b2)	(b1)	(b0)
dec.	27	71	116	(x2)	(x1)	(x0)	(y2)	(y1)	(y0)	(b2)	(b1)	(b0)

(hhh)			(www)			(vvv)			(oo)	
(h2)	(h1)	(h0)	(w2)	(w1)	(w0)	(v2)	(v1)	(v0)	(o1)	(o0)
(h2)	(h1)	(h0)	(w2)	(w1)	(w0)	(v2)	(v1)	(v0)	(o1)	(o0)

Parameter:

(xxx) ..... X-co-ordinate of the reference point

(yyy) ..... Y-co-ordinate of the reference point

(bbb) ..... Width of the rectangular area

(hhh) ..... Height of the rectangular area

(www) ..... Trend value 1
Permitted range: $0 \leq (www) \leq (hhh) - 1$

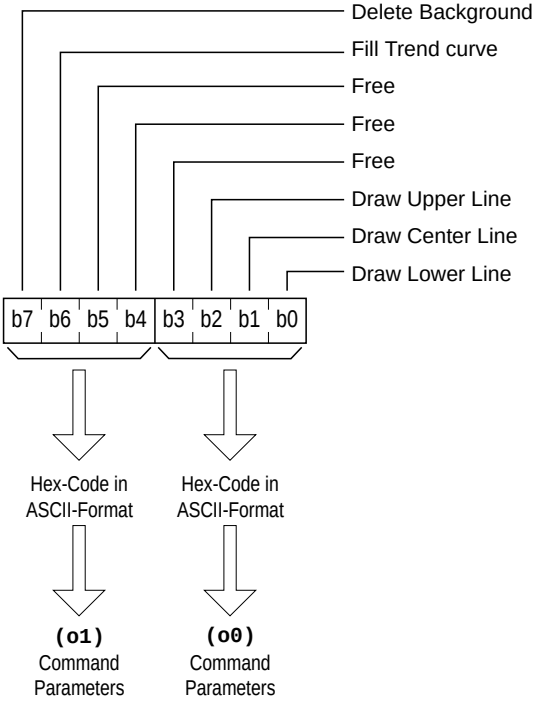
(vvv) ..... Trend value 2
Permitted range: $0 \leq (vvv) \leq (hhh) - 1$

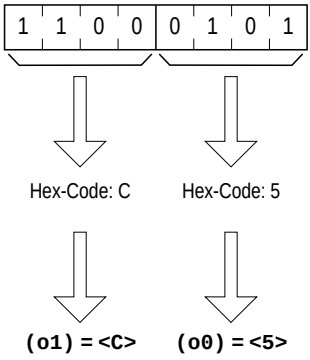
(oo) ..... Options for the trend display. The options are coded bit-wise and can be combined.

Options: The options to be set are coded bit-wise and can be combined optionally with each other. They do not influence each other.

Example:

A trend segment with options *Delete background, Fill trend curve* and *Draw upper/lower line* should be drawn. The following bits must be set to 1:





These two bytes must be entered in the command sequence:

Syntax	(oo)	
ASCII	<C>	<5>
hexadec.	43	35
dec.	67	53

NEXT TREND SEGMENT

Description: A trend consists of several trend segments. Since most of the trend segments use the same parameters (width, height, options) and get the position for the following segment easily from the segment width and the old position (x = x + width), a simplified command consisting of only those parameters required for segment 2 can be used to call the following segment. This command only functions well after at least one trend segment has been drawn. The use of this command is optional. Naturally the entire trend can be drawn with the trend segment command.

Command:

Syntax	<ESC>	<G>	<c>	(vvv)		
hexadec.	1B	47	63	(v2)	(v1)	(v0)
dec.	27	71	99	(v2)	(v1)	(v0)

Parameter: **(vvv) .....** Trend value 2.
Permitted range: 0 ≤ (vvv) ≤ (hhh) - 1
For trend range 1 the old trend value 2 is used.

SCROLL TREND

Description: If one trend window is absolutely full, the existing trend curve must be moved to the left when a new value is received. The oldest value is lost and the new value is added to the right end. The *Scroll Trend* Executes both functions. First the pixel information, which is covered by parameters rectangle x, y, width and height is moved by one segment width to the left. The free position left is now filled with the new trend segment.

Command:

Syntax	<ESC>	<G>	<m>	(xxx)			(yyy)			(bbb)		
hexadec.	1B	47	74	(x2)	(x1)	(x0)	(y2)	(y1)	(y0)	(b2)	(b1)	(b0)
dec.	27	71	116	(x2)	(x1)	(x0)	(y2)	(y1)	(y0)	(b2)	(b1)	(b0)

(hhh)			(sss)			(www)			(vvv)			(oo)	
(h2)	(h1)	(h0)	(s2)	(s1)	(s0)	(w2)	(w1)	(w0)	(v2)	(v1)	(v0)	(o1)	(o0)
(h2)	(h1)	(h0)	(s2)	(s1)	(s0)	(w2)	(w1)	(w0)	(v2)	(v1)	(v0)	(o1)	(o0)

Parameter:

(xxx) ..... X-co-ordinate of the reference point (upper left corner point)

(yyy) ..... Y-co-ordinate of the reference point (upper left corner point)

(bbb) ..... Width of the rectangular surface (X-extension)

(hhh) ..... Height of the rectangular surface (Y-extension)

(sss) ..... Width of a trend segment in pixels.
The contents of the rectangle defined with (xxx), (yyy), (bbb) and (hhh) is moved by (sss) pixels to the left and a trend segment of the same width is inserted in its place.

(www)..... Trend value 1
Permitted range: $0 \leq (www) \leq (hhh) - 1$

(vvv) ..... Trend value 2
Permitted range: $0 \leq (vvv) \leq (hhh) - 1$

(oo)..... Options for a trend display. The options are coded bit-wise and can be combined optionally (the options are described on page *33* under the command *Trend segment*).

10 Miscellaneous Commands

The entire character set for graphic displays is held in non-volatile OTP (one time programmable) memory and cannot be written to. It contains the standard ASCII character set (32 - 126) as well as symbol, Cyrillic and Greek characters. The characters for standard (1*1) and double size (2*2) are included but in order to display (4*4) size characters, they must be created from the 2*2 size characters. Every character of both character sets can be redefined with an ESC sequence. Redefined characters can only be displayed after they are entered. If a picture with a modified character set is to be displayed, the characters must first be redefined and the picture created later.

1*1 Character Definition

Description: For graphic displays, it is possible to redefine all characters in the 1*1 character set, in which the corresponding ASCII number is given like a string with the new bit pattern.

Command:

Syntax	<ESC>	<d>	(zz)		(pp)		....		(pp)	
hexadec.	1B	64	(z1)	(z0)	(p1)	(p0)	....	....	(p1)	(p0)
dec.	27	100	(z1)	(z0)	(p1)	(p0)	....	....	(p1)	(p0)
					8 Pixel patterns (pp) for each 2 bytes => 16 bytes					

Parameter: **(zz) .....** Number of the ASCII character, to be redefined.
Permitted ASCII char.: Decimal: 32 - 126, 128 - 255
Hexadecimal: 20 - 7E, 80 - FF
(pp)..... Pixel pattern
The amount of pixel patterns to be sent depends on the display type and its character sizes (e.g. 8 pixels high and 6 pixels wide).

Example: The space character (ASCII number $32_{DEC}/20_{HEX}$) is to be replaced by the following character:

Since the binary pattern of a row is only six pixels long, the pixel pattern of a row is justified from the right within a byte (8 bits).

Pixel pattern
■ ■ ■ ■ ■
■ ■ ■ ■
■ ■ ■ ■
■ ■ ■ ■ ■
■ ■ ■ ■
■ ■ ■ ■
■ ■ ■ ■ ■

Binary	Hex.
00**11 1110**	**3E**
00**10 0010**	**2A**
00**10 0010**	**2A**
00**11 1110**	**3E**
00**10 0010**	**2A**
00**10 0010**	**2A**
00**11 1110**	**3E**
00**00 0000**	**00**

Command for the example:

Syntax	<ESC>	<d>	(zz)		(pp)		(pp)		(pp)		(pp)		(pp)		(pp)		(pp)		(pp)	
ASCII	<ESC>	d	20		3E		2A		2A		3E		2A		2A		3E		00	
hexadec.	1B	64	32	30	33	45	32	41	32	41	33	45	32	41	32	41	33	45	30	30
dec.	27	100	48	48	51	69	50	65	50	65	51	69	50	65	50	65	51	69	48	48

Command sequence length: 20 bytes

2*2 CHARACTER DEFINITION

Description: For graphic displays, it is possible to redefine all characters in the 2*2 character set, in which the corresponding ASCII number is given like a string with the new bit pattern.

Command:

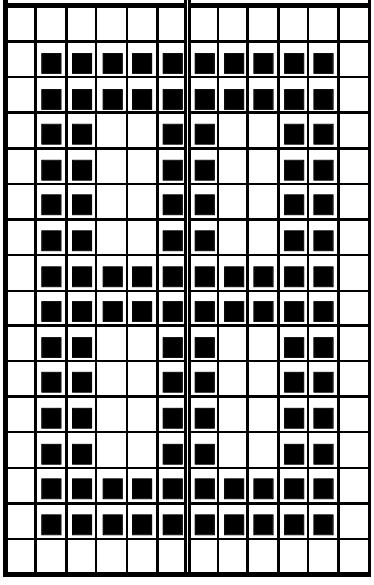
Syntax	<ESC>	<D>	(zz)		(pppp)				....	(pppp)			
hexadec.	1B	44	(z1)	(z0)	(p3)	(p2)	(p1)	(p0)	....	(p3)	(p2)	(p1)	(p0)
dec.	27	68	(z1)	(z0)	(p3)	(p2)	(p1)	(p0)	....	(p3)	(p2)	(p1)	(p0)
					16 pixel patterns (pp) for each 4 bytes => 64 bytes								

Parameter: **(zz) .....** Number of the ASCII character, to be redefined.
Permitted ASCII char.: Decimal: 32 - 126, 128 - 255
Hexadecimal: 20 - 7E, 80 - FF

(pp) ..... Pixel pattern
The amount of pixel patterns to be sent depends on the display type and its character sizes (e.g. 16 pixels high and 12 pixels wide).

Example: The space character (ASCII number $32_{DEC}/20_{HEX}$) is to be replaced by the following character.

Pixel pattern	
Left	Right



Binary		Hex.	
0000 0000	0000 0000	00	00
0001 1111	0011 1110	1F	3E
0001 1111	0011 1110	1F	3E
0001 1001	0010 0110	19	26
0001 1001	0010 0110	19	26
0001 1001	0010 0110	19	26
0001 1001	0010 0110	19	26
0001 1111	0011 1110	1F	3E
0001 1111	0011 1110	1F	3E
0001 1001	0010 0110	19	26
0001 1001	0010 0110	19	26
0001 1001	0010 0110	19	26
0001 1001	0010 0110	19	26
0001 1111	0011 1110	1F	3E
0001 1111	0011 1110	1F	3E
0000 0000	0000 0000	00	00

Command for the example:

Syntax	<ESC>	<D>	(zz)		(pppp)				(pppp)				(pppp)				(pppp)			
ASCII	<ESC>	D	20		<0000>				<1F3E>				<1F3E>				<1926>			
hexadec.	1B	44	32	30	00	00	00	00	31	46	33	45	31	46	33	45	31	39	32	36
dec.	27	68	50	48	0	0	0	0	49	70	51	69	49	70	51	69	49	57	50	54

(pppp)				(pppp)				(pppp)				(pppp)				(pppp)				(pppp)			
<1926>				<1926>				<1926>				<1F3E>				<1F3E>				<1926>			
31	39	32	36	31	39	32	36	31	39	32	36	32	41	33	45	32	41	32	41	31	39	32	36
49	57	50	54	49	57	50	54	49	57	50	54	50	65	51	69	50	65	50	65	49	57	50	54

(pppp)				(pppp)				(pppp)				(pppp)				(pppp)				(pppp)			
<1926>				<1926>				<1926>				<1F3E>				<1F3E>				<0000>			
31	39	32	36	31	39	32	36	31	39	32	36	31	46	33	45	31	46	33	45	00	00	00	00
49	57	50	54	49	57	50	54	49	57	50	54	49	70	51	69	49	70	51	69	0	0	0	0

Command sequence length: 68 bytes

LOAD 1*1 STANDARD CHARACTER SET

Description: The 1*1 standard character set is reactivated from the non-volatile memory and the redefined character set is deleted.

Command:

Syntax	<ESC>	<x>
hexadec.	1B	78
dec.	27	120

LOAD 2*2 STANDARD CHARACTER SET

Description: The 2*2 standard character set is reactivated from the non-volatile memory and the redefined character set is deleted.

Command:

Syntax	<ESC>	<X>
hexadec.	1B	58
dec.	27	88

BRIGHTNESS ADJUSTMENT

Description: For some displays the brightness of the background can be changed. If a brightness adjustment is possible this command can be executed, otherwise it is ignored.

Command:

Syntax	<ESC>	<h>	(hh)	
hexadec.	1B	68	(h1)	(h0)
dec.	27	104	(h1)	(h0)

Parameter: **(hh) .....** The brightness definition is done with a percentage entry. Most display modules only have a small range of steps for the brightness adjustment, therefore often the same background brightness is seen for different values.
Permitted value range: <0><0> to <9><9>

SET TIME FOR BACKGROUND LIGHTING

Description: Because of the short life span of the liquid crystal film for LCD displays, it is an advantage to protect it. By shutting the display off after a certain period of not being used (no key presses), the film is saved and the life span is increased. The amount of time which should pass is set with this command. This command can also be used to switch the lighting explicitly on or off.

Command:

Syntax	<ESC>	<b>	(tt)	
hexadec.	1B	62	(t1)	(t0)
dec.	27	98	(t1)	(t0)

Parameter: **<tt> .....** Time in minutes.

(tt)	Description
00	Lighting is switched off. In this case the lighting is also not switched back on with a key press.
01 - 98	Length of time for the screen to stay active after the last key press or screen command in minutes.
99	The lighting is switched on and remains on, until the lighting is switched off again with (tt) = 0. If the time has been set, the display will go blank after the given amount of time.

RESET TIME FOR BACKGROUND LIGHTING

Description: The user software can reactivate the background lighting with this command (e.g. for an alarm), without the user having to press a key. After receiving the command, the background lighting is activated for the defined amount of time (as for a key press). If the time is set with (00) or with (99), this sequence has no effect.

Command:

Syntax	<ESC>	<r>
hexadec.	1B	72
dec.	27	114

STATUS REQUEST

Description: The PLC can request a status string from the panel which contains information on the configuration of the panel or on hardware errors and the setting of the number switch with this command.

Command:

Syntax	<ESC>	<S>
hexadec.	1B	53
dec.	27	83

The response string is structured exactly the same as the start message, which appears on the screen after power-on. This string is 40 characters long. In order to differentiate the status string from key presses, the ASCII character <DC2> is sent before the string and <DC4> after.

Structure of the string:

	Start	0.....1.....2.....3..... 01234567890123456789012345678901234567890	End
Status-String	<DC2>	Version: x.y Status: abccdefgh	<DC4>
hexadecimal	12	Corresponding ASCII table	14
decimal	18	Corresponding ASCII table	20

Status:

x ..... Operating system version number
y ..... Operating system distribution number
a ..... Display code
- 1 ..... VFD Display 2 x 20
- 3 ..... VFD Display 2 x 40
- 4 ..... LCD Display 4 x 20
- 5 ..... LCD Display 2 x 20
- 6 ..... LCD Display 8 x 40, graphics capable
- E ..... LCD Display 4 x 40
- F ..... LCD Display 16 x 40, graphics capable

b ..... Number switch setting for the operating mode
cc ..... Number switch setting for the handshake and parity
d ..... Number switch setting for the baudrate
e ..... Number of connected KeyPad modules
f ..... KeyPad module error
g ..... RAM error
h ..... EPROM error

If an incorrect setting is detected on the number switch (e.g. Operating mode '9'), it is indicated with an '**X**'.
Error messages '**fgh**' are shown with a '**0**' for *No Error* or a '**1**' for *Error*.

REQUEST EXTENDED STATUS

Description: The PLC can request an *Extended status string* from the panel which contains more detailed information about the panel used.

Command:

Syntax	<ESC>	<E>
hexadec.	1B	45
dec.	27	69

The string is 20 characters long. In order to differentiate the status string from key presses, the ASCII character <DC2> is sent before the string and <DC4> is sent after.

Structure of the string:

	Start	0.........1......... 01234567890123456789	End
Status-String	<DC2>	aabbcddeeXXXXXXXXXX	<DC4>
hexadecimal	12	Corresponding ASCII table	14
decimal	18	Corresponding ASCII table	20

Status:
aa ..... Number of lines
bb ..... Number of columns (characters per line)
c ..... Information, whether, the display is graphics capable
0 ..... Not graphics capable
1 ..... Graphics capable
dd ..... Height of a 1*1 character in pixels (only on graphic displays)
ee ..... Width of a 1*1 character in pixels (only on graphic displays)
X ..... Free for future expansion

DISPLAY - REQUEST CONTENTS OF A LINE

Description: With this command from the PLC, the panel is requested to send the contents of a defined line on the display to the PLC. Attributes, such as blinking characters and graphic elements are ignored.

Command:

Syntax	<CSI>	<i>	(zz)	
hexadec.	9B	69	(z1)	(z0)
dec.	155	105	(z1)	(z0)

Parameter: **(zz) .....** Line number
Permitted values: <0><1> - <?><?> (depends on display type)

Structure of the string:

	Start	ASCII-String (Length depends on display)	End
Status-String	<DC2>	. . . . .	<DC4>
hexadecimal	12	Corresponding ASCII table	14
decimal	18	Corresponding ASCII table	20

RESET

Description: The panel is put into the same state as after a power-on.

Command:

Syntax	<ESC>	<R>
hexadec.	1B	52
dec.	27	82

In principle this command can be thought of as a combination of the following commands:

- ❒ SINGLE key mode for all keys
- ❒ Set wait time to the default value
- ❒ Set repeat frequency to default value
- ❒ Activate t_{off} code transmission for all keys
- ❒ All LEDs off
- ❒ Cursor on
- ❒ Clear screen
- ❒ All attributes off
- ❒ 1*1 character size
- ❒ Create 1*1 standard character set
- ❒ Create 2*2 standard character set
- ❒ Set time for background lighting to default value
- ❒ Timeout for commands off

SET TIMEOUT

Description: With this command, a time can be set within which one complete (!) command sequence must be sent. The panel waits for the completion of a command sequence which has begun and at the same time decrements a wait counter which is set with the first character. After the counter has run down, the character which have been received are thrown out. This function can be switched off.

Command:

Syntax	<ESC>	<t>	(zz)	
hexadec.	1B	74	(z1)	(z0)
dec.	27	116	(z1)	(z0)

Parameter: **(zz) .....** Time for the timeout in 100 msec steps

(tt)	Description
00	The function is switched off. No timeout monitor is active.
01 - 99	Time in 100 msec steps (100 msec to 9.9 sec).

Default: Timeout monitor switched off.

11 C130 Commands

The command set is VT100/C100 compatible and has been expanded for the C130 CAN Controller. The expansion includes a new command for setting the minimum delay between the individual CAN frames when sending data from the control panel to the PCC. An existing command was also changed.

Expansions to the VT100/C100 Command Set

SET MINIMUM DELAY (NEW COMMAND)

Description: This command can be used to set the minimum amount of time that must pass between two CAN frames which have been sent from the C130 controller to the PCC. The maximum delay is 999 msec and can be set in steps of 1 msec.
The default delay is 10 msec since the control panel sends a reset code and, if necessary, an error code to the PCC after initialization. The control panel can only receive data or commands after sending the reset code. This value guarantees that a receive task running on the PCC in task class 1 [10 msec] can receive all data.
Without this delay, data blocks could be sent every 1 msec (worst case).

Command:

Syntax	<ESC>	<Y>	(zzz)
hexadec.	1B	59	(z2)(z1)(z0)
dec.	27	89	(z2)(z1)(z0)

Parameter: **(zzz) .....** Delay in steps of 1 msec.
Valid values: <0><0><0> to <9><9><9>

If the minimum delay is set to 000, the maximum transfer rate is valid.

EXPANDED STATUS REQUEST

Description: This command can be used on the PCC to request a status string from the control panel which contains information about the panel configuration or hardware errors and the setting of the number switches.

Command:

Syntax	<ESC>	<S>
hexadec.	1B	53
dec.	27	83

Structure of the String Sent:

	Start	0.....1.....2.....3..... 01234567890123456789012345678901234567890123456789	End
Status-String	<DC2>	Version: x.y Status: abccdefgh	<DC4>
hexadecimal	12	Corresponding ASCII table	14
decimal	18	Corresponding ASCII table	20

Version:
x ..... Operating System Version Number
y ..... Operating System Revision Number

Status: a ..... Display Code

0 - No display connected	5 - LCD Display 2 x 20
1 - VFD Display 2 x 20	6 - LCD Display 8 x 40, graphic capable
3 - VFD Display 2 x 40	E - LCD Display 4 x 40
4 - LCD Display 4 x 20	F - LCD Display 16 x 40, graphic capable

b ..... Character C will always be output [C for CAN].
cc ..... CAN node number [1 to 32].
d ..... Baudrate: corresponds to the first 2 bits of the first hex dial (see "Number Dials" section).
0 ... 250 KBaud, 1 ... 125 KBaud, 2 ... 20 KBaud, 3 ... 500 KBaud
e ..... Number of Keypad Module Connected
f ..... Keypad Module Error
g ..... RAM Error
h ..... EPROM Error

13 Error Messages

hex.	dec.	Description
00 - 0F	**0 - 15**	t_{on} codes (see Key Codes)
10	**16**	Not used
11	**17**	<XON> (reserved for VT100 Emulation Software-Handshake)
12	**18**	<DC2> (String start)
13	**19**	<XOFF> (reserved for VT100 Emulation Software-Handshake)
14	**20**	<DC4> (String end)
15 - 1F	**21-31**	Not used
20 - 7D	**32-127**	t_{on} codes (see Key Codes)
80 - 8F	**128-143**	t_{off} codes (see Key Codes)
90	**144**	Reset executed on panel (respective keys were pressed)
91	**145**	Defect keypad module
92	**146**	Number of keypad modules changed
93	**147**	Keypad modules OK
94	**148**	Display not detected
95	**149**	RAM is defect
96	**150**	EPROM is defect
97	**151**	Command sequence interrupted (e.g. Timeout, <ESC> from PLC, unknown command sequence, invalid parameter)
98	**152**	No re-definable characters (only with graphic displays)
99 - 9F	**153-159**	Not used
A0 - FF	**160-255**	t_{off} codes (see Key Codes)

14 Error Correction

Error code (hex.)	Description	Solution
91	Defect keypad module	This error can only occur directly after a power-on or reset. The following steps help to find the cause of the error: 1. Are the cables between keypad modules and the panel controller OK? 2. Is the termination resistor in the last module? 3. Are all keypad modules in good condition? (Hardware exchange)
92	Number of keypad modules has changed	This message can occur during operation. Check modules the same as is described for error code 91.
94	Display not detected	Check for the following: 1. Is the connection between the display module and the panel controller OK? 2. For newly developed display modules, an operating system update may be required. 3. Display module is defect (Hardware exchange)
95	RAM is defect	Display module is defect (Hardware exchange)
96	EPROM defect	Display module is defect (Hardware exchange)

APPENDIX C
CHARACTER SETS

1 Character Sets

The character sets which are available for use on the PANELWARE display modules.

- Character Set for VFD and Graphic Capable LCD Displays
- Character Set for Character Oriented LCD Displays

2 Character Set - VFD / Graphic Capable LCD Displays

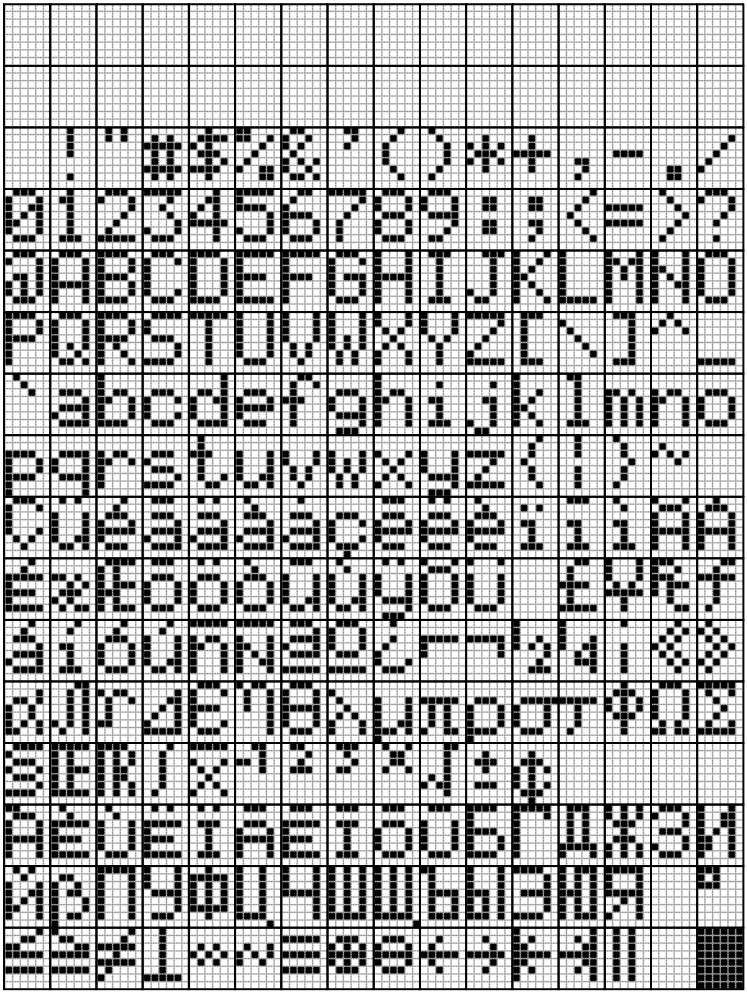
Dec.	Hex.	Character	Control Character	Dec.	Hex.	Character	Control Character
000	$00			032	$20		SPC
001	$01			033	$21	!	
002	$02			034	$22	"	
003	$03			035	$23	#	
004	$04			036	$24	$	
005	$05			037	$25	%	
006	$06			038	$26	&	
007	$07			039	$27	´	
008	$08		BS	040	$28	(	
009	$09			041	$29	)	
010	$0A		LF	042	$2A	*	
011	$0B			043	$2B	+	
012	$0C			044	$2C	,	
013	$0D			045	$2D	-	
014	$0E			046	$2E	.	
015	$0F			047	$2F	/	
016	$10			048	$30	0	
017	$11		XON	049	$31	1	
018	$12		DC2	050	$32	2	
019	$13		XOFF	051	$33	3	
020	$14		DC4	052	$34	4	
021	$15			053	$35	5	
022	$16		SYN	054	$36	6	
023	$17			055	$37	7	
024	$18			056	$38	8	
025	$19			057	$39	9	
026	$1A			058	$3A	:	
027	$1B		ESC	059	$3B	;	
028	$1C			060	$3C	<	
029	$1D			061	$3D	=	
030	$1E			062	$3E	>	
031	$1F			063	$3F	?	

Dec.	Hex.	Character	Control Character	Dec.	Hex.	Character	Control Character
064	$40	@		096	$60	`	
065	$41	A		097	$61	a	
066	$42	B		098	$62	b	
067	$43	C		099	$63	c	
068	$44	D		100	$64	d	
069	$45	E		101	$65	e	
070	$46	F		102	$66	f	
071	$47	G		103	$67	g	
072	$48	H		104	$68	h	
073	$49	I		105	$69	i	
074	$4A	J		106	$6A	j	
075	$4B	K		107	$6B	k	
076	$4C	L		108	$6C	l	
077	$4D	M		109	$6D	m	
078	$4E	N		110	$6E	n	
079	$4F	O		111	$6F	o	
080	$50	P		112	$70	p	
081	$51	Q		113	$71	q	
082	$52	R		114	$72	r	
083	$53	S		115	$73	s	
084	$54	T		116	$74	t	
085	$55	U		117	$75	u	
086	$56	V		118	$76	v	
087	$57	W		119	$77	w	
088	$58	X		120	$78	x	
089	$59	Y		121	$79	y	
090	$5A	Z		122	$7A	z	
091	$5B	[		123	$7B	{	
092	$5C	\		124	$7C	|	
093	$5D	]		125	$7D	}	
094	$5E	^		126	$7E	~	
095	$5F	_		127	$7F		DEL

Dec.	Hex.	Character	Control Character	Dec.	Hex.	Character	Control Character
128	$80	Ç		160	$A0	á	
129	$81	ü		161	$A1	í	
130	$82	é		162	$A2	ó	
131	$83	â		163	$A3	ú	
132	$84	ä		164	$A4	n̄	
133	$85	à		165	$A5	N̄	
134	$86	å		166	$A6	ª	
135	$87	ç		167	$A7	º	
136	$88	ê		168	$A8	¿	
137	$89	ë		169	$A9	⌐	
138	$8A	è		170	$AA	¬	
139	$8B	ï		171	$AB	½	
140	$8C	î		172	$AC	¼	
141	$8D	ì		173	$AD	¡	
142	$8E	Ä		174	$AE	«	
143	$8F	Å		175	$AF	»	
144	$90	É		176	$B0	α	
145	$91	æ		177	$B1	л	
146	$92	Æ		178	$B2	γ	
147	$93	ô		179	$B3	Δ	
148	$94	ö		180	$B4	ε	
149	$95	ò		181	$B5	η	
150	$96	û		182	$B6	θ	
151	$97	ù		183	$B7	λ	
152	$98	ÿ		184	$B8	μ	
153	$99	Ö		185	$B9	π	
154	$9A	Ü		186	$BA	ρ	
155	$9B		CSI	187	$BB	σ	
156	$9C	£		188	$BC	τ	
157	$9D	¥		189	$BD	ϕ	
158	$9E	Pτ		190	$BE	┘	
159	$9F	ƒ		191	$BF	Σ	

Dec.	Hex.	Character	Control Character	Dec.	Hex.	Character	Control Character
192	$C0	§		224	$E0	Й	
193	$C1			225	$E1	ß	
194	$C2			226	$E2	П	
195	$C3	‹		227	$E3	у	
196	$C4	X̄		228	$E4	Ф	
197	$C5	¹		229	$E5	Ц	
198	$C6	²		230	$E6	Ч	
199	$C7	³		231	$E7	Ш	
200	$C8			232	$E8	Щ	
201	$C9	¨		233	$E9	Ъ	
202	$CA	±		234	$EA	Ы	
203	$CB	¢		235	$EB	Э	
204	$CC		FREE	236	$EC	Ю	
205	$CD		FREE	237	$ED	Я	
206	$CE		FREE	238	$EE		FREE
207	$CF		FREE	239	$EF	°	
208	$D0	À		240	$F0	∸	
209	$D1	É		241	$F1	≤	
210	$D2	Ù		242	$F2	∓	
211	$D3	Ë		243	$F3	⌋	
212	$D4	Ï		244	$F4	⁰	
213	$D5	Â		245	$F5	~	
214	$D6	Ê		246	$F6	≡	
215	$D7	Î		247	$F7	⊔	
216	$D8	Ô		248	$F8	⊖	
217	$D9	Û		249	$F9	←	
218	$DA	Ь		250	$FA	–	
219	$DB	Г		251	$FB	↖	
220	$DC	Д		252	$FC	→|	
221	$DD	Ж		253	$FD	‖	
222	$DE	З		254	$FE		FREE
223	$DF	И		255	$FF		FREE

2.1 Characters for VFD / Graphic Capable LCD Displays (6 x 8 Grid)



3 Character Set - Character Oriented LCD Displays

Dec.	Hex.	Character	Control Character	Dec.	Hex.	Character	Control Character
000	$00			032	$20		SPC
001	$01			033	$21	!	
002	$02			034	$22	"	
003	$03			035	$23	#	
004	$04			036	$24	$	
005	$05			037	$25	%	
006	$06			038	$26	&	
007	$07			039	$27	´	
008	$08		BS	040	$28	(	
009	$09			041	$29	)	
010	$0A		LF	042	$2A	*	
011	$0B			043	$2B	+	
012	$0C			044	$2C	,	
013	$0D			045	$2D	-	
014	$0E			046	$2E	.	
015	$0F			047	$2F	/	
016	$10			048	$30	0	
017	$11		XON	049	$31	1	
018	$12		DC2	050	$32	2	
019	$13		XOFF	051	$33	3	
020	$14		DC4	052	$34	4	
021	$15			053	$35	5	
022	$16		SYN	054	$36	6	
023	$17			055	$37	7	
024	$18			056	$38	8	
025	$19			057	$39	9	
026	$1A			058	$3A	:	
027	$1B		ESC	059	$3B	;	
028	$1C			060	$3C	<	
029	$1D			061	$3D	=	
030	$1E			062	$3E	>	
031	$1F			063	$3F	?	

Dec.	Hex.	Character	Control Character	Dec.	Hex.	Character	Control Character
064	$40	@		096	$60	`	
065	$41	A		097	$61	a	
066	$42	B		098	$62	b	
067	$43	C		099	$63	c	
068	$44	D		100	$64	d	
069	$45	E		101	$65	e	
070	$46	F		102	$66	f	
071	$47	G		103	$67	g	
072	$48	H		104	$68	h	
073	$49	I		105	$69	i	
074	$4A	J		106	$6A	j	
075	$4B	K		107	$6B	k	
076	$4C	L		108	$6C	l	
077	$4D	M		109	$6D	m	
078	$4E	N		110	$6E	n	
079	$4F	O		111	$6F	o	
080	$50	P		112	$70	p	
081	$51	Q		113	$71	q	
082	$52	R		114	$72	r	
083	$53	S		115	$73	s	
084	$54	T		116	$74	t	
085	$55	U		117	$75	u	
086	$56	V		118	$76	v	
087	$57	W		119	$77	w	
088	$58	X		120	$78	x	
089	$59	Y		121	$79	y	
090	$5A	Z		122	$7A	z	
091	$5B	[		123	$7B	{	
092	$5C	¥		124	$7C	|	
093	$5D	]		125	$7D	}	
094	$5E	^		126	$7E	→	
095	$5F	_		127	$7F	←	

Dec.	Hex.	Character	Control Character	Dec.	Hex.	Character	Control Character
128	$80		FREE	160	$A0		FREE
129	$81	ü		161	$A1	｡	
130	$82		FREE	162	$A2	｢	
131	$83		FREE	163	$A3	｣	
132	$84	ä		164	$A4	､	
133	$85		FREE	165	$A5	･	
134	$86		FREE	166	$A6	ｦ	
135	$87		FREE	167	$A7	ｧ	
136	$88		FREE	168	$A8	ｨ	
137	$89		FREE	169	$A9	ｩ	
138	$8A		FREE	170	$AA	ｪ	
139	$8B		FREE	171	$AB	ｫ	
140	$8C		FREE	172	$AC	←	
141	$8D		FREE	173	$AD	ｭ	
142	$8E	Ä		174	$AE	→	
143	$8F		FREE	175	$AF	ｯ	
144	$90		FREE	176	$B0	ｰ	
145	$91		FREE	177	$B1	ｱ	
146	$92		FREE	178	$B2	ｲ	
147	$93		FREE	179	$B3	ｳ	
148	$94	ö		180	$B4	ｴ	
149	$95		FREE	181	$B5	ｵ	
150	$96		FREE	182	$B6	ｶ	
151	$97		FREE	183	$B7	ｷ	
152	$98		FREE	184	$B8	ｸ	
153	$99	Ö		185	$B9	ｹ	
154	$9A	Ü		186	$BA	ｺ	
155	$9B		CSI	187	$BB	ｻ	
156	$9C		FREE	188	$BC	ｼ	
157	$9D		FREE	189	$BD	ｽ	
158	$9E		FREE	190	$BE	ｾ	
159	$9F		FREE	191	$BF	ｿ	

Dec.	Hex.	Character	Control Character	Dec.	Hex.	Character	Control Character
192	$C0	ｸﾞ		224	$E0		FREE
193	$C1	ｹﾞ		225	$E1		FREE
194	$C2	ｺﾞ		226	$E2		FREE
195	$C3	ｻﾞ		227	$E3		FREE
196	$C4	ｼﾞ		228	$E4		FREE
197	$C5	ｽﾞ		229	$E5		FREE
198	$C6	ｾﾞ		230	$E6		FREE
199	$C7	ｿﾞ		231	$E7		FREE
200	$C8	ﾀﾞ		232	$E8		FREE
201	$C9	ﾁﾞ		233	$E9		FREE
202	$CA	ﾂﾞ		234	$EA		FREE
203	$CB	ﾃﾞ		235	$EB		FREE
204	$CC	ﾄﾞ		236	$EC		FREE
205	$CD	ﾊﾞ		237	$ED		FREE
206	$CE	ﾋﾞ		238	$EE		FREE
207	$CF	ﾌﾞ		239	$EF		FREE
208	$D0	ﾍﾞ		240	$F0		FREE
209	$D1	ﾎﾞ		241	$F1		FREE
210	$D2	ﾊﾟ		242	$F2		FREE
211	$D3	ﾋﾟ		243	$F3		FREE
212	$D4	ﾌﾟ		244	$F4		FREE
213	$D5	ﾍﾟ		245	$F5		FREE
214	$D6	ﾎﾟ		246	$F6		FREE
215	$D7	ｳﾞ		247	$F7		FREE
216	$D8	ｦﾞ		248	$F8		FREE
217	$D9	ﾙﾞ		249	$F9		FREE
218	$DA	ﾚﾞ		250	$FA		FREE
219	$DB	ﾛﾞ		251	$FB		FREE
220	$DC	ﾜﾞ		252	$FC		FREE
221	$DD	ﾝﾞ		253	$FD		FREE
222	$DE	ｰﾞ		254	$FE		FREE
223	$DF	｡		255	$FF		FREE

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RELEVANT CONVERSIONS

RELEVANT CONVERSIONS

METRIC AND IMPERIAL EQUIVALENTS

Some of the values in this manual and in other documentation that you may have contain values which are only given in metric. Follow the formulas and charts on this page to help with any conversion problems that you may have.

TEMPERATURE

Below are two formulas to help in the conversion from Fahrenheit to Centigrade and vice versa.

LINEAR MEASURE & WEIGHTS

All B&R documentation includes the product dimensions, weights, distances for cabling and cutout sizes in metric. Use the conversions below to calculate these measurements into the equivalent English units.

Fahrenheit °F	Metric °C
-40	-40
-20	-28.89
-10	-23.33
-5	-20.56
0	-17.78
5	-15.00
10	-12.22
15	-9.44
20	-6.67
25	-3.89
30	-1.11
35	1.67
40	4.44
45	7.22
50	10.00
55	12.78
60	15.56
65	18.33
70	21.11
75	23.89
80	26.67
85	29.44
90	32.22
95	35.00
100	37.78
105	40.56
110	43.33
115	46.11
120	48.89
125	51.67
130	54.44
135	57.22
140	60.00
145	62.78
150	65.56

Metric °C	Fahrenheit °F
-40	-40.00
-35	-31.00
-30	-22.00
-25	-13.00
-20	-4.00
-15	5.00
-10	14.00
-5	23.00
0	32.00
5	41.00
10	50.00
15	59.00
20	68.00
25	77.00
30	86.00
35	95.00
40	104.00
45	113.00
50	122.00
55	131.00
60	140.00
65	149.00
70	158.00
75	167.00
80	176.00
85	185.00
90	194.00

5/9 x (°F - 32) = °C
(9/5 x °C) + 32 = °F

English Units	Metric Units
1 inch	25.4 millimeters 2.54 centimeters
1 foot	30.48 centimeters 3.048 decimeters 0.3048 meter
1 yard	0.9144 meter
0.03937 inch	1 millimeter
0.3937 inch	1 centimeter
3.937 inches	1 decimeter
39.37 inches 3.2808 feet 1.0936 yards	1 meter
3280.8 feet 1093.6 yards 0.62137 mile	1 kilometer

English Units	Metric Units
1 pound	0.45359 kilogram
1 ounce	28.350 grams
1 short ton	907.18 kilograms 0.90718 metric tons
1 long ton	1016.0 kilograms 1.0160 metric tons