FIRECLASS FC600 Series Panels and Repeaters

Installation Guide

120.515.930_FC-FC600-P-I

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Contents

1 Introduction

Use this guide as a source of useful information when installing a FireClass FC600 series alarm system.

The guide sets out a recommended series of steps to follow.

Not all the steps are covered in detail, as this would be beyond the scope of the guide, and these details are provided in other documentation (see also "What this manual does not cover") below. Rather, the guide provides an overall sequence and context for the installation.

1.1 Keywords and symbols

In this manual symbols are used in the margin to indicate warnings, and also 'hints and tips' type information.

These are explained in Table 1.

Keyword	Symbol	Explanation
DANGER		Warning. Imminent danger. Death or severe injury when disregarded.
WARNING		Warning. Potentially dangerous situation. Death or severe injury possible when disregarded.
CAUTION		Warning. Potentially dangerous situation. Minor injury possible when disregarded.
NOTICE		Warning. Potentially dangerous situation. Material damage possible when disregarded.
		Helpful information.

Table 1: Keywords and symbols in this documentation

1.2 Who this manual is for

This guide is aimed at suitably qualified technicians who have received training and are experienced in the installation of fire detection and alarm systems.

1.3 What this manual does not cover

The guide does not provide information on the following:

- System design.

  The system must already be designed and planned for the specific site, in terms of cable routing, device selection and layout, mains supply etc.

  For more information, see the FireClass FC600 Series Product Application and Design Information guide. This includes details of optional modules that can be fitted.
- Local regulations.

  For example cable specifications and panel siting restrictions are expected to be covered by local regulations. Because these factors need to be incorporated into the design, they are excluded from this guide.

  Local regulations are expected to cover, for example:
  - Wiring specifications
  - Panel siting restrictions
  - Provision for mains isolation
  - Earthing arrangements
  - Environmental conditions
  - Qualifications of personnel.

    For example there may be a stipulation that the connections for the mains supply and protective earth can only be made by a qualified electrician.
- Installation of detector bases and ancillaries.

  Refer to the respective installation (wiring) instructions.
- Installation of optional modules.

  These products have their own specific instructions; however this guide does provide supplemental information for installation in the FireClass FC600 series panel where necessary.
- Procedures covered by another of the guides are available for the FireClass FC600 fire panel range.

  For example in the FireClass FC600 Panels Commissioning Instructions, there are various tests to be performed using operator functions as described in the FireClass FC600 User Manual.

2 Installation notes

There is a section of installation notes in the FireClass FC600 Panels Product Application and Design Information guide. Check these for information possibly affecting your installation, such as the arrangement of multiple stacked cards.

3 Safety warnings

DANGER

The FireClass Panel contains high voltages, producing a danger of death or serious injury while working on the panel.

Note the dangerous voltage warning sticker on the PSU.

Follow all steps and note all warnings in this guide relating to electrical safety and earthing.

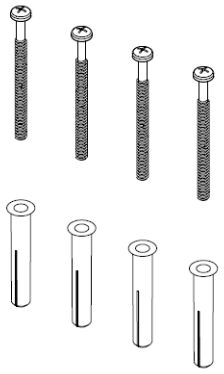

Fig. 1:Screws and wall plugs (the screws are approximately 63mm long)

4 FireClass FC600 series panels

The FireClass FC600 range consists of the following panels:

- FC602S.
  This is a two loop FireClass panel with a shallow housing. This panel can have two standard power loops or one high power loop with a maximum of 250 addresses. It features a colour LCD display with 32 zonal LEDs. The panel has a compact housing and a BAW75T24 PSU for 17AH batteries. The FC602S is a networkable panel.

- FC604S. This is a four loop FireClass panel with a shallow housing. This panel can have four standard power loops or two high power loops with a maximum of 500 addresses. It features a colour LCD display with 32 zonal LEDs. The panel has a designer housing and BAQ140T24 PSU for 17AH batteries. The FC604S is a networkable panel.

- FC602S Scandinavian. This is a two loop FireClass panel with a shallow housing. This panel can have two standard power loops or one high power loop with a maximum of 250 addresses. It features a colour LCD display with 32 zonal LEDs. The panel has a compact housing with a fireman's keyswitch and a BAW75T24 PSU for 17AH batteries. The FC602S Scandinavian is a networkable panel.

- FC604S Scandinavian. This is a four loop FireClass panel with a shallow housing. This panel can have four standard power loops or two high power loops with a maximum of 500 addresses. It features a colour LCD display with 32 zonal LEDs. The panel has a compact housing with a fireman's keyswitch and

BAQ140T24 PSU for 17AH batteries. The FC604S Scandinavian is a networkable panel.

4.1 Optional mounting plate

The FC600 series panels are not supplied with a mounting plate. Mounting plates are available to purchase using part number 557.202.921. They can be used with all panels except for DC Repeaters. See Figures 2 and 3.

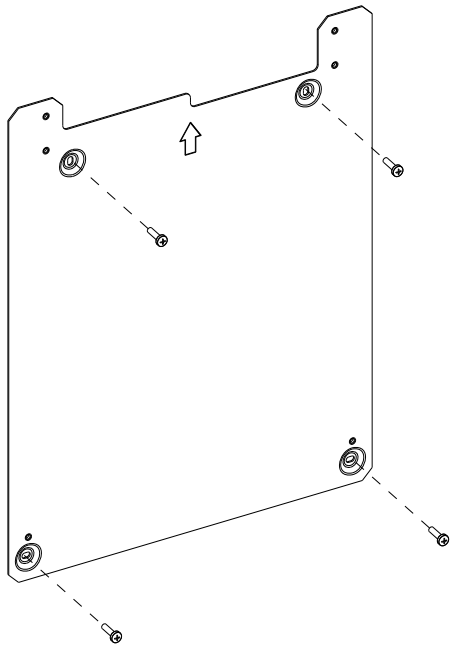

Fig. 2: Optional mounting plate 557.202.921, available to purchase.

4.2 Mounting a FC600 series panel to the wall without a mounting plate

For an overview of the panel, see Fig. 4. To mount a FC600 series panel without the optional mounting plate, complete these steps:

1 Decide on a wall mounting method (typically screws into rawl plugs), and assess the required sizes of the fastenings. Take into account the type of wall (solid brick, wood and so on), and the weight of the assembled control panel housing.

2 For the upper mounting holes, mark on the wall the drill hole positions. Drill and plug the holes.

3 Insert screws to suspend the housing from the upper holes. The housing may feature "keyholes" to allow you to insert the screws into the bare wall, then drop the housing onto the screws (rather than screwing with the housing in position, through the back wall.

4 Ensure the housing is horizontal. For the lower mounting holes, mark on the wall the drill hole positions. Drill and plug the bottom fixing holes. Insert screws to complete fixing the housing to the wall.

5 Check the housing is physically secure.

6 Remove any debris from the housing.

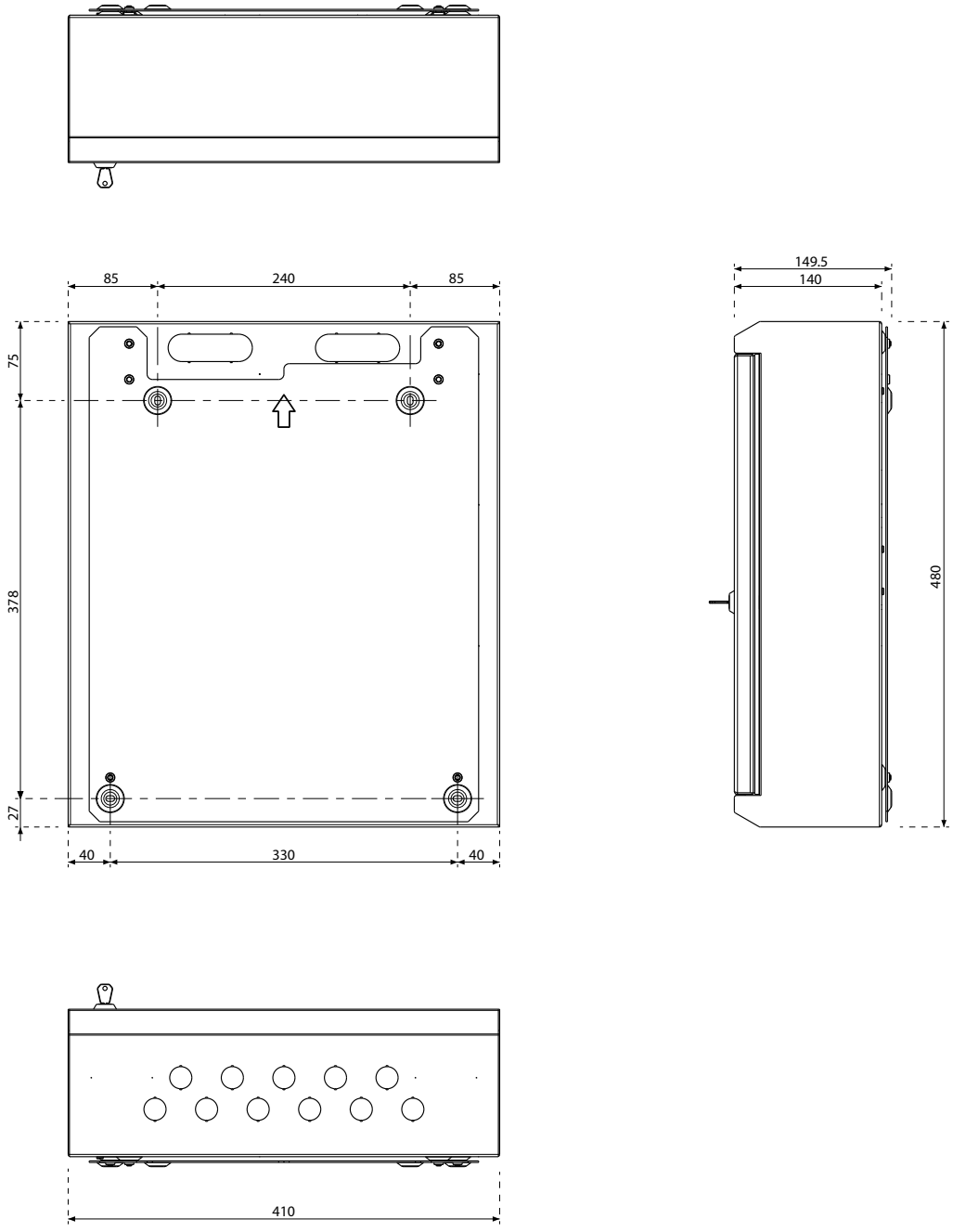

Fig. 3: FC602S/FC604S panel, FC602S/FC604S Scandinavian panel, and the FC32AR/FC32AR AC Scandinavian repeaters mounting with a universal mounting plate - fixing and overall dimensions in mm

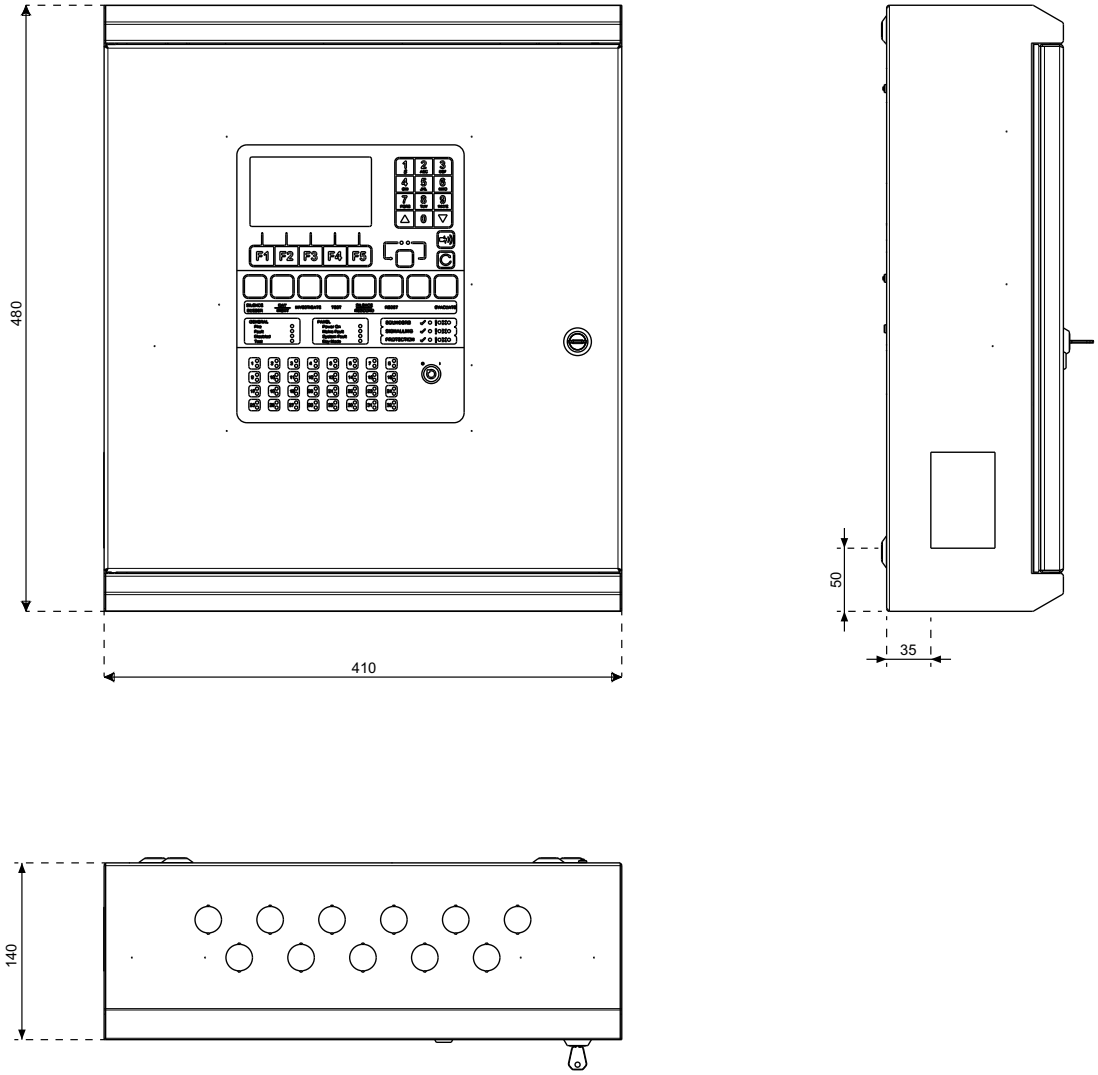

Fig. 4: FC602S and FC604S panels with shallow housing, and the FC32AR AC repeater - overall dimensions in mm

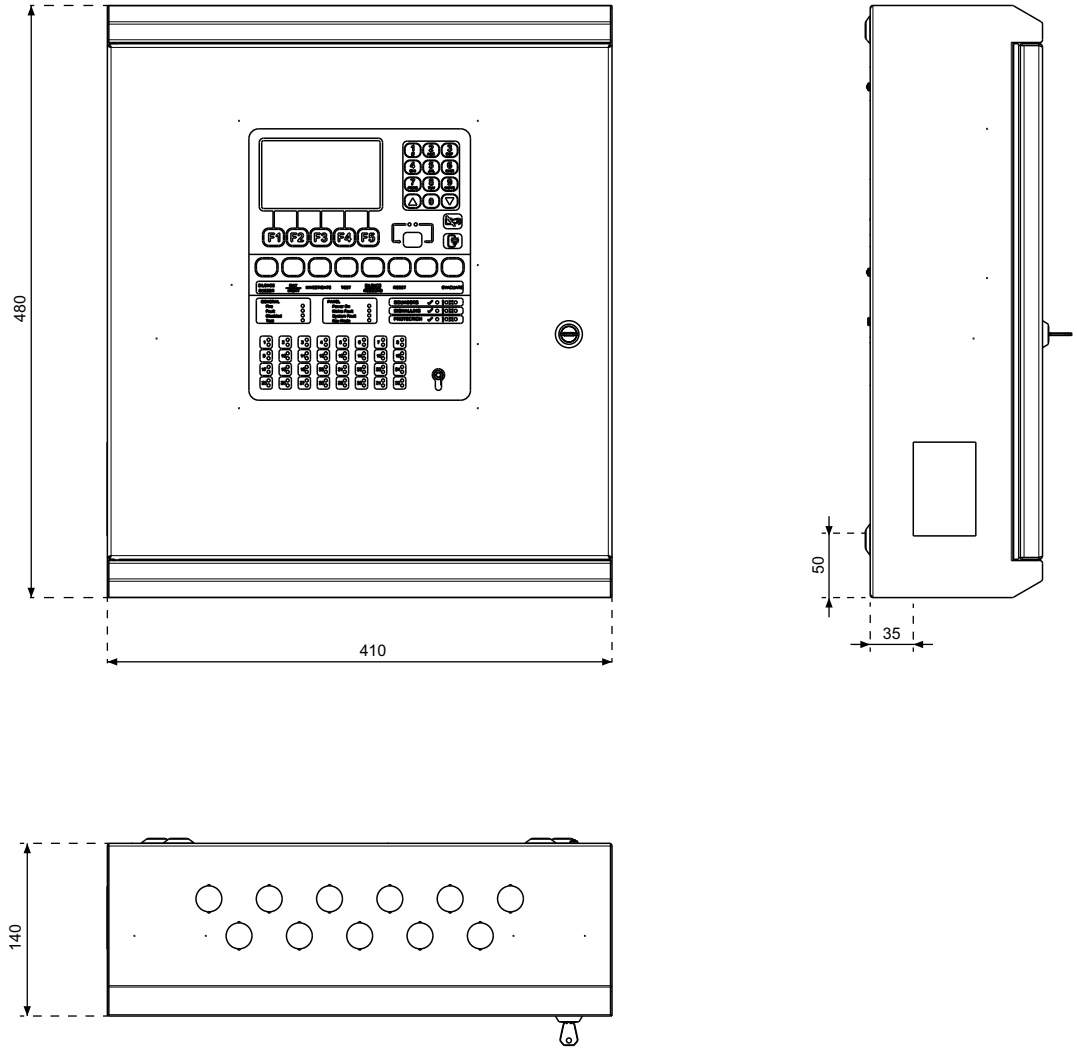

Fig. 5: FC602S/FC604S Scandinavian panel - overall dimensions in mm

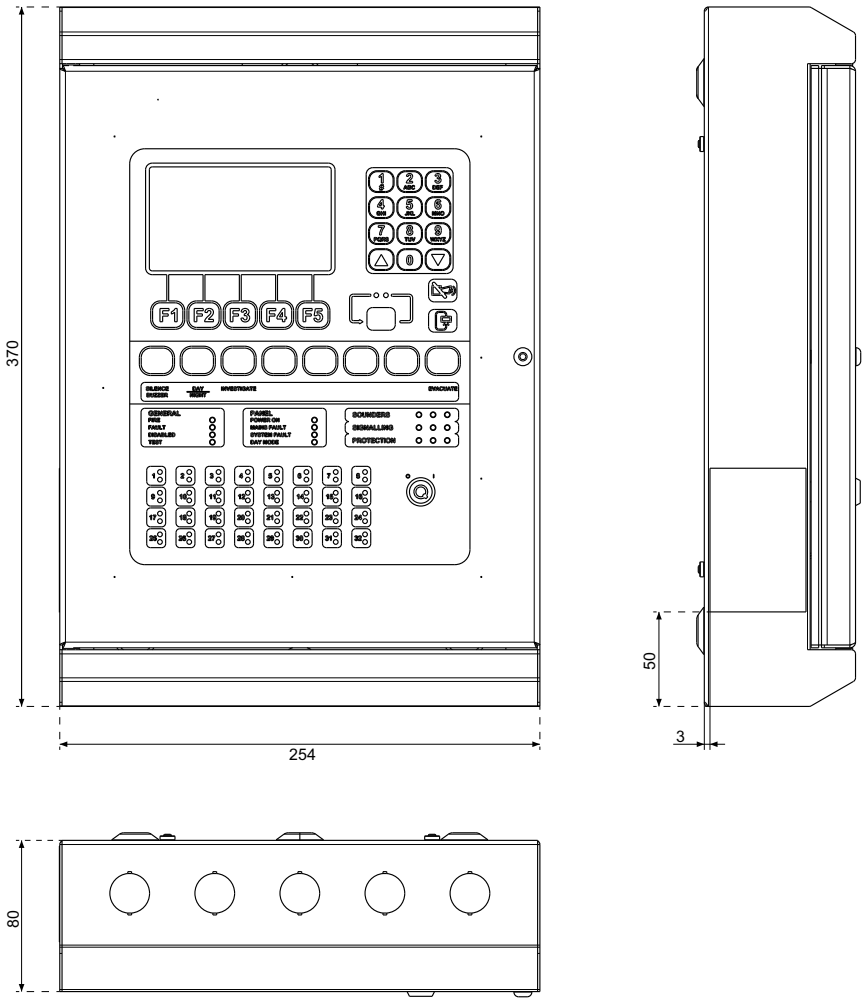

Fig. 6: FC32DR DC repeater - overall dimensions in mm

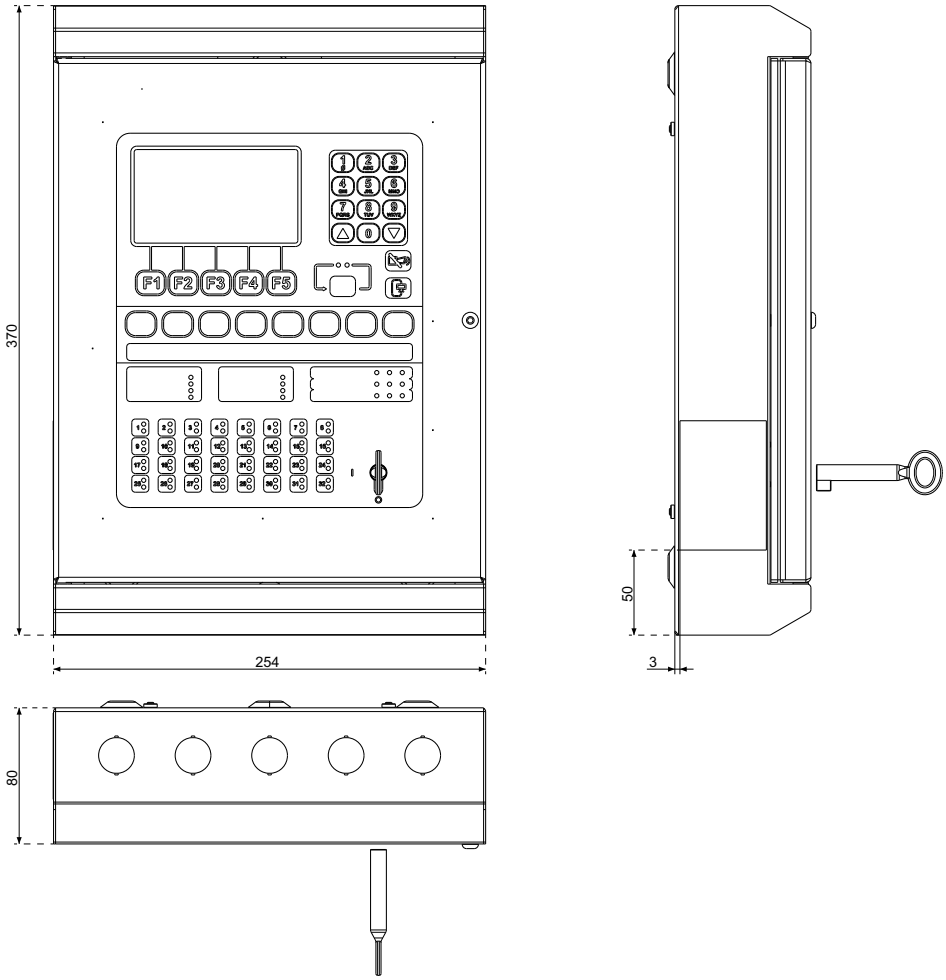

Fig. 7: FC32DR DC Scandinavian repeater - overall dimensions in mm

5 Inter-unit cabling

NOTICE

There is a danger of signal interference between cable runs.

Take care when laying out transmission lines to avoid the potential for cross-coupling between them.

5.1 Connecting the mains cable and protective earths in FC600 series panels and AC repeaters

DANGER

Danger of death or serious injury.

Before working on the Mains connection, verify that the cabling is not live. Ensure the cabling is not connected to the supply, or that the supply is isolated.

DANGER

The FireClass panel contains high voltages, producing a danger of death or serious injury.

You must ensure adequate earthing of the system.

In addition to any earthing requirements in the local regulations, additionally you must, also follow these stipulations:

- **All exposed metalwork and cabling conduits must be returned to earth at the control panel.**
- **The control panel housing must be earthed, following the procedures as mentioned in this guide.**

WARNING

Particularly in harsh environments, to ensure proper operation of the control panel, a second earth, separate from the mains lead earth, must be installed. This is described in the following section.

To connect the Mains cable and protective earth, complete the following steps:

1 Make sure the Mains cable is not connected to the supply, or that the supply is isolated.
2 On the PSU, locate the Mains connector at the top of the unit. If the protective cover is fitted to this connector, remove it.
3 Connect the Mains cable to its connector. Fix the Mains cable using the clip near the Mains connector.
4 Connect the protective earth conductor of the Mains to a terminal of the housing earthing point.
5 Particularly in harsh environments, it may be necessary to connect an additional low resistance earth-conductor to the solid earth bar in the closest distribution unit (stranded wire > 2.5 mm^2).

NOTE: Earthing through the mains distribution may not provide the best path for HF currents.

NOTE: Most AC power distribution systems will include a low impedance protective earth; however IT power distribution systems either have no earth or high impedance to earth. In these cases, a local low impedance protective earth is required.

6 Re-fit the PSU Mains connector cover.
7 Make sure system 0 V is not connected to the earth, as there is an earth fault monitoring circuit.

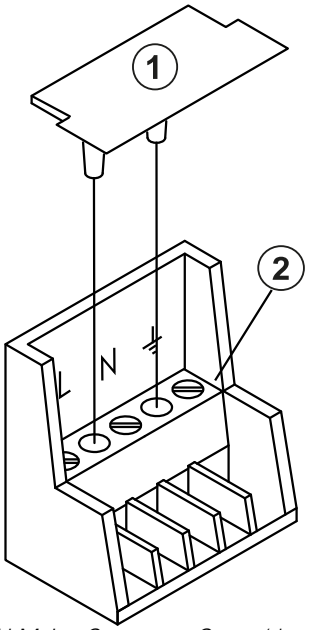

Fig. 8: PSU Mains Connector Cover (detail)
1– Cover
2– PSU Mains connector

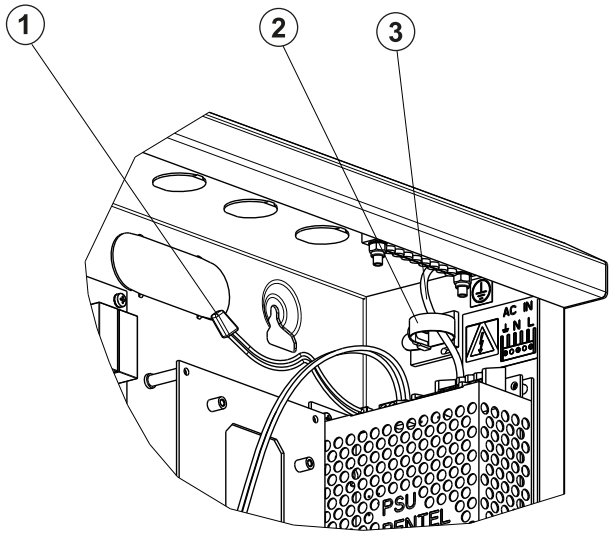

Fig. 9: PSU Mains connections on FC602S/FC604S panel, FC602S/FC604S Scandinavian panel, and FC32AR/FC32AR AC Scandinavian repeaters
1 – Thermistor assembly
2 – Cable tie
3 – PSU Earth wire

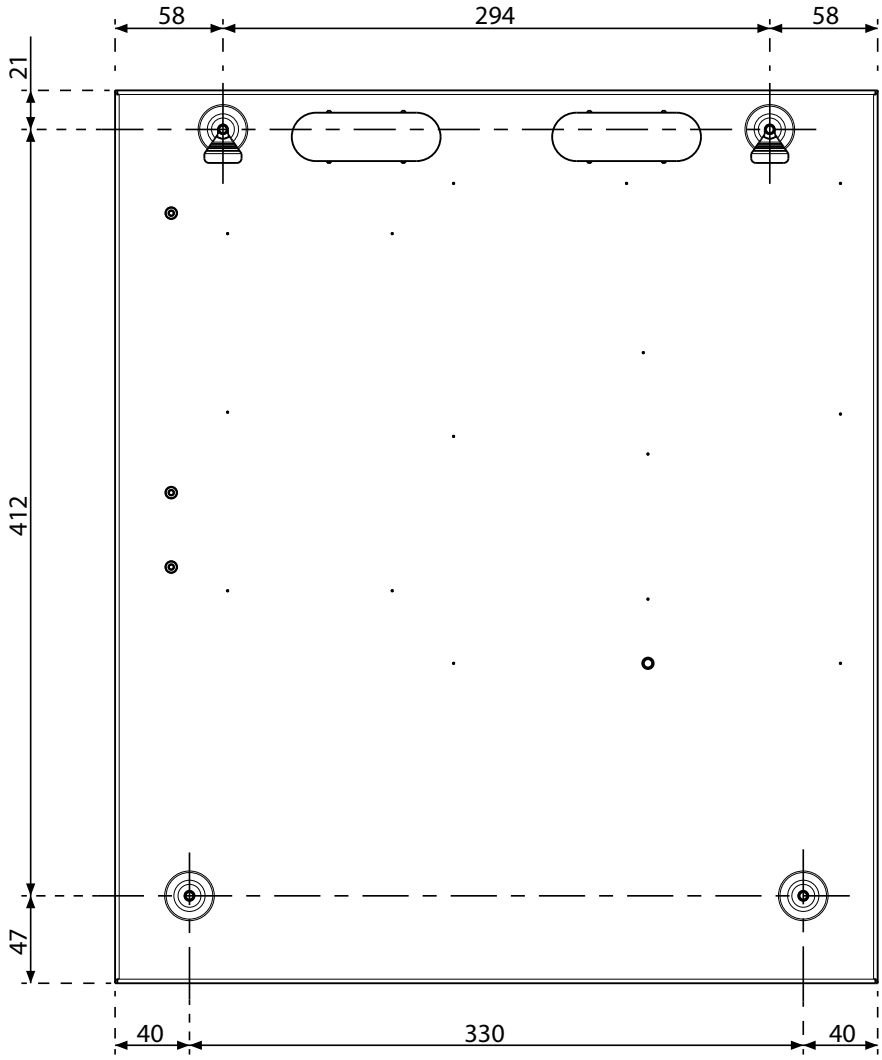

Fig. 10: FC32AR/FC32AR AC Scandinavian repeaters without mounting plate - fixing and overall dimensions in mm

6 Loops installation

As detailed below, the procedure is to install the loops into the building, making temporary wiring arrangements for testing. Then, once testing has been completed, the final loop connections can be made.

6.1 Running and temporarily connecting the loops

1 Run the loop wiring around the building, and wire in the bases, according to the system plan. Similarly, run any other wiring required for ancillary modules. Clearly label the loop conductors as being positive or negative.

At this stage, do not wire in any isolator bases, or other modules, or fit the detectors. This is to avoid potential damage caused by the high voltage insulation checks. Use strip connectors (Fig. 11) for any temporary connections, to preserve continuity.

For connection details see the individual leaflets or labels provided with the products.

2 At the control panel, feed the loop cables through the appropriate knockouts. Use suitable cable glands as needed. To maintain IP30 pass test status, use a

M20 cable gland with a locknut. Leave generous tails of wire (approximately 600 mm length).

3 Connect the loop wiring tails to a strip type connector block, with screw terminals, as shown in Fig. 11. Leave the wiring loose within the panel.

4 Ensure that the loop screens and metal sheath are not connected to the addressable loop conductors and are left floating relative to earth.

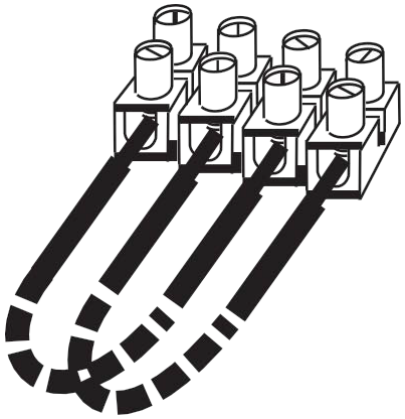

Fig. 11: Temporary Loop Connection
The dashed lines represent loop wiring

6.1.1 Interface conventional detectors

If necessary, use a FC410DIM or FC410DDM interface unit to interface conventional detectors on a loop spur.

For details refer to the documentation for the FC410-DIM or FC410DDM unit.

6.2 Making insulation checks

NOTICE

There is danger of damage to equipment. Before using a high-voltage insulation tester, ensure that no devices liable to be damaged are fitted to the circuit. This includes isolator bases and ancillary modules.

1 Note that a record should be made of the measurements below, to be handed over to the customer.

2 Ensure your insulation checks will be at 500 V (set your meter accordingly).

3 Make the usual insulation measurements. For example measure the resistance between the two wires of the loops, and the resistance between the loop wires and earth.

4 For values less than 1 MOhm this is a failure and the panel will not operate. In this case investigate and correct the problem.

5 For values between 1 MOhm and 30 MOhm, investigate and try to increase the resistance value to 30 MOhm.

6.3 Wiring the remaining modules

At this stage, wire the remaining modules and isolator bases into the loops.

6.4 Measuring loop resistance

1 Note that a record should be made of the measurements below, to be handed over to the customer.

2 Make the usual loop positive resistance measurements.

3 Check whether the values are acceptably close to the anticipated values calculated at the design stage.

4 Remove the temporary connections that you had made to the connector block. Refer to Fig. 11.

6.5 Connecting the loops fully

1 Wire the loop wires into their connectors. Refer to Fig. 12.

For the pin-out details, use labelling for the loop connections on the board. The loops are connected to the FC-FI or the FC-FI-1 board depending on the panel. The FC602S and the FC602S Scandinavian use a FC-FI-1; the FC604S and the FC604S Scandinavian use a FC-FI board.

2 Plug the connectors to their board sockets.

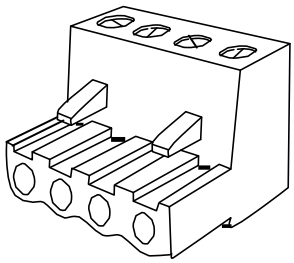

Fig. 12: Loop Wire Connector

7 Installing the batteries

Battery variations

Your batteries may differ from the ones shown in the illustrations below (which are POWER SONIC 17 AH batteries).

DANGER

The standby batteries can deliver high current, producing a danger of injury and equipment damage while working on the panel.

Take care not to accidentally short the battery terminals, especially when fitting the retaining bracket. The batteries are supplied charged.

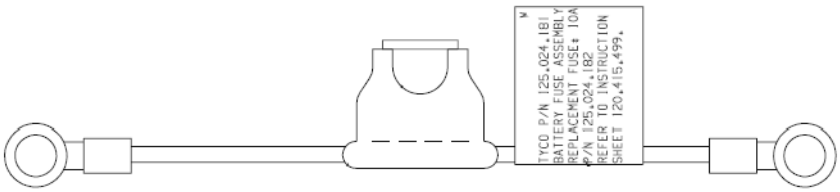

Fig. 13: Battery in-line fuse kit

WARNING

The standby batteries can deliver high current, producing a danger of injury and equipment damage while working on the panel.

Take care not to accidentally short the battery terminals, especially when fitting the retaining bracket.

The batteries are supplied charged.

Note: FireClass FC600 series panels do not have a separate battery box.

Note

- The battery must be of the VRLA type (valve regulated lead acid).
- The battery must have an enclosure with flammability class UL94V-1 or better.
- The battery must comply with all applicable standards indicated in paragraph M.2.1 of standard EN 62368-1:2014 "Requirements (safety of batteries and their elements)"; in this case, the standards: IEC 60896-21:2004 and IEC 60896-22:2004.
- The battery must be replaced by a skilled person.

1 Connect the battery cables to the terminals marked XT10 **BAT+** and **BAT-** on the FC-FI/FC-FI-1 board. Connect the red cable to positive and the black cable to negative.

2 Place the batteries at bottom of the control panel housing.

3 Connect the battery cables to the battery +ve to -ve terminals.

4 Locate the Fuse Kit in Line (refer to Fig. 13). From the kit, remove the fuse and keep this safely (you will be inserting the fuse later as part of the commissioning procedure). Connect the remaining battery terminals using the kit.

5 Identify the temperature compensation thermistor lead. Connect the thermistor to terminals labelled XT10 **TEMP** on the FC-FI/FC-FI-1 board. Tape this thermistor and the thermistor from the mains PSU (see Fig. 9) at the end of the lead, at a convenient location on the top of a battery.

6 Re-fit the battery fuse.

7 Label the batteries with the current date.

8 Mounting CUI repeater panels

Complete the instructions in the following sections to mount a FC32DR DC colour user interface (CUI) repeater. For FC32AR repeaters, see section 5.1, "Connecting the mains cable and protective earths in FC600 series panels and AC repeaters" on page 11.

8.1 Connecting the CUI repeater DC supply cabling

DC colour user interface (CUI) repeaters are powered from the control panel. To connect the repeater DC supply cabling, complete the following steps:

1 Identify suitable DC supply wire. Strip off the insulation to leave a few millimetres of bare wire ends.
2 At the control panel feed the wire into the housing through a suitable knockout, using a gland if necessary.
3 Note which colour conductor is connected to which terminal on the panel to the 24 V & 0 V.
4 At the CUI repeater feed the supply cable through a suitable knockout, using a gland if necessary.
5 Connect the 24 V and 0 V to the appropriate terminal block.

Note

The CUI repeater has two independent Left & Right power input connections. Connect to either the Left or Right Power terminal block. Connect the 24 V & 0 V to the appropriate terminal blocks on the CUI repeater, matching the colours to the terminals. See Fig. 14.

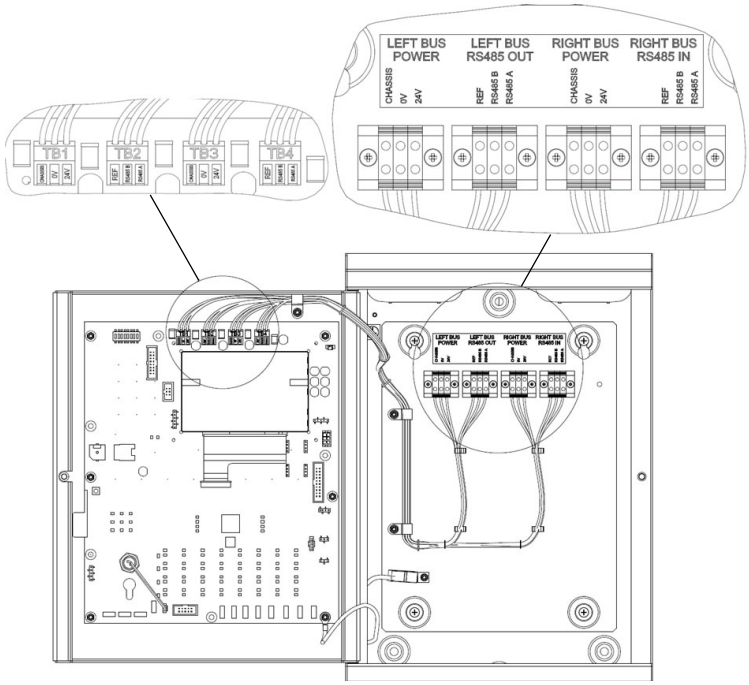

Fig. 14: Terminal blocks on the CUI repeater PCB and housing

CUI PCB label	Function	Housing Terminal Block label
TB1	Left Power connections for repeater CUI Pin1 - CHASSIS Pin2 - 0V Pin3 - +24V DC	LEFT BUS POWER Label - CHASSIS Label - 0V Label - 24V
TB2	Left RBUS connections for repeater CUI Pin1 - RS485 NET REF Pin2 - RS485 B Pin3 - RS485 A	LEFT BUS RS485 OUT Label - REF Label - RS485 B Label - RS485 A
TB3	Right Power connections for repeater CUI Pin1 - CHASSIS Pin2 - 0V Pin3 - +24V DC	RIGHT BUS POWER Label - CHASSIS Label - 0V Label - 24V
TB4	Right RBUS connections for repeater CUI Pin1 - RS485 NET REF Pin2 - RS485 B Pin3 - RS485 A	RIGHT BUS RS485 IN Label - REF Label - RS485 B Label - RS485 A

Table 1: List of CUI connections

8.2 Connecting the CUI repeater RBus wires

1 Wire the "control panel end" of the RBus wires into their connector, XT1 on the FC-FI labelled LEB/ RBUS, A, B and GND. The connector is similar to the loop connector.

2 Feed these wires out of the control panel through a suitable knockout using a gland if necessary.

3 There are two RBUS channels available. For Left RBUS connections use housing terminal blocks labelled LEFT BUS RS485 OUT. For Right RBUS use housing terminal blocks RIGHT BUS RS485 IN, as shown in Table 2.

4 Double-check whether an EOLR resistor needs to be fitted. There are links on the CUI repeater to add 120R termination on the RBUS. Link pins 2 and 3 on the 3-pin connectors CON5 & CON6 to add this resistance or no links equates to no additional termination resistance.

5 At the CUI repeater, feed the RBus wires through the appropriate knockout, using glands as necessary.

6 For the RBUS connections, if there are 2 separate left and right channels available, connect to the appropriate left and right channel housing terminal blocks. If only one RBUS channel is available, connect to the RIGHT BUS RS485 IN channel. See Table 2 for details.

7 Connect the RBus cable screen to the housing earth connector. (Do not earth the screen at the repeater end, it must only be earthed at one end.)

8 Check whether an isolator IC needs to be fitted to the CUI repeater.

Note: The need for an isolator must be established at the system design stage, so check whether an isolator IC has been included in the equipment consignment. In general, an isolator IC is fitted to all AC powered repeaters. The isolator provides protection when there may be different mains supply or ground reference voltages at the control panel, compared to these voltages at the CUI repeater. This may occur if there is a large distance between the panel and CUI repeater.

9 If you need to fit an isolator IC, fit a DC-DC Converter to socket SK1 on the CUI Repeater.

10 When you fit the DC-DC converter, make sure that the LK3 & LK4 links on the CUI repeater are not linked.

11 Set the address and baud rate using the DIP switch S1 on the CUI Repeater. Make the baud rate setting according to Table 4. Make the address setting according to Table 3. For the address, set the switch to OFF for binary 0, or ON for binary 1. The DIP switch S1 location is on the top left-hand side, see items 1 to 4 in Fig. 16. You may use a small screwdriver to move the switch sliders.

12 S1-8: Processor Fault Sensing option.The Default position is OFF (disabled) for normal operation. Only set ON if required to generate a "local" processor-fault for any fault condition on the panel. Legacy-function for old hardware.

	Binary Switch Position			
Address	**1**	**2**	**3**	**4**
1	ON	OFF	OFF	OFF
2	OFF	ON	OFF	OFF
3	ON	ON	OFF	OFF
4	OFF	OFF	ON	OFF
5	ON	OFF	ON	OFF
6	OFF	ON	ON	OFF
7	ON	ON	ON	OFF
8	OFF	OFF	OFF	ON
9	ON	OFF	OFF	ON
10	OFF	ON	OFF	ON
11	ON	ON	OFF	ON
12	OFF	OFF	ON	ON
13	ON	OFF	ON	ON
14	OFF	ON	ON	ON
15	ON	ON	ON	ON

Table 2: Repeater address setting

Baud Rate	**DIP Switch position 5**	**DIP Switch position 6**	**Baud Rate**	**DIP Switch posi-tion 5**
4800	ON	OFF	4800	ON
9600	OFF	ON	9600	OFF
19200*	ON	ON	19200	ON

Table 3: Repeater baud rate setting
**Default*

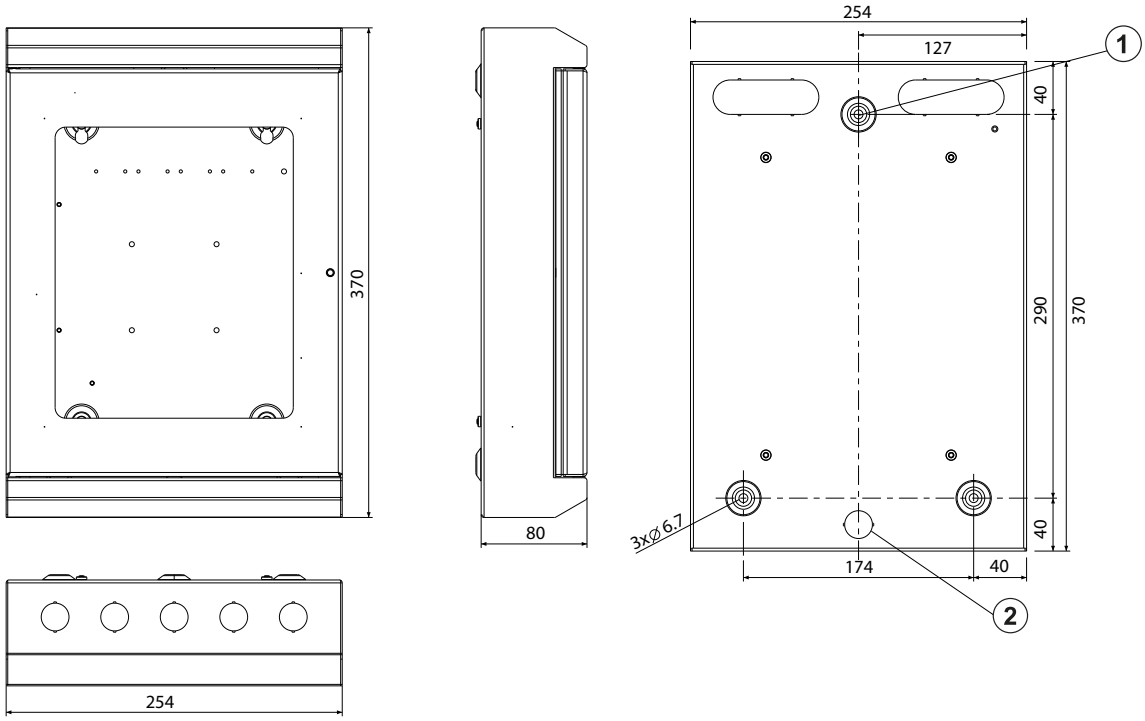

Fig. 15: FC32DR DC repeater and FC32DR Scandinavian DC repeater - fixing and overall dimensions in mm
1– Mounting hole
2– Knockout

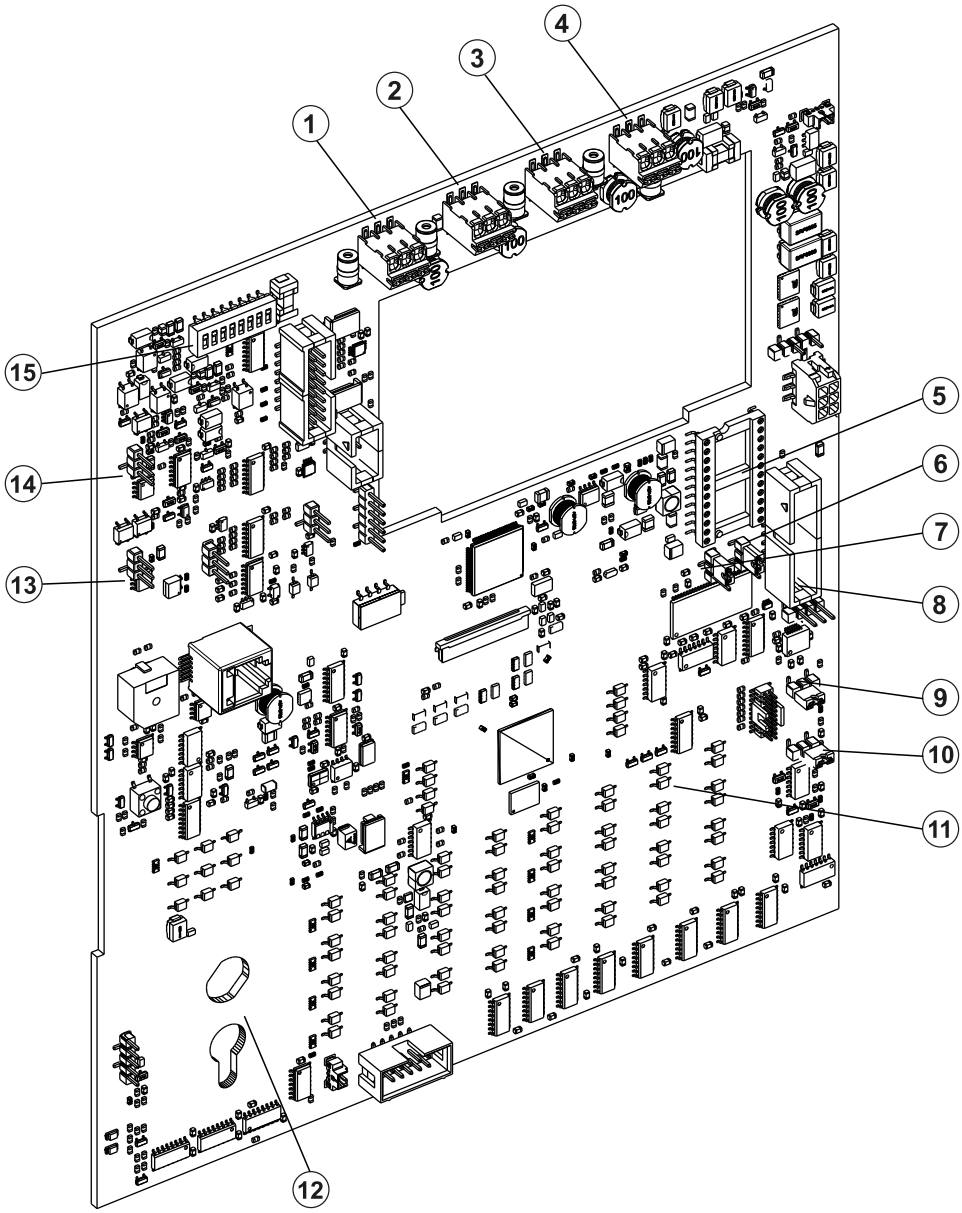

Fig. 16: CUI - Colour User Interface (557.202.919)

1– TB1
2– TB2
3– TB3
4– TB4
5– DC-DC converter position (If used for repeater. Plug into socket SK1 for repeater version).
6– Link L3 fit 2-3 if no DC-DC converter
7– Link L4 fit 1-2 if no DC-DC converter
8– X900 - 20 way ribbon cable connection to PFI800/PFI801
9– X204 - Boot-mode link. Link 1-2 normal run mode. Link 2-3 boot-loader mode.
10–X200 - Watchdog link. Link 2-3 normal run mode. Link 1-2 watch-dog disabled mode.
11–Zonal LEDs
12–Keyswitch
13–CON6 - 120R termination on RS485 comms. Link 2-3 to add 120R termination.
14–CON5 - 120R termination on RS485 comms. Link 2-3 to add 120R termination.
15–S1 DIP switch - Used to set the RBUS address and Baud rate. 1-4 RBUS Address. 5-6 Baud Rate select. 7-8 Future Use

9 Provide installation records

Provide site personnel with all relevant information, such as cable routing diagrams and wiring test results.

10 Make final checks

1 Check that all power and signal cabling connections are secure and using the correct polarity.
2 Check that all power and signal cables are neatly routed and arranged in the housings.
3 Check that the earth cables connections are secure.
4 Check that all installed cables and signal wires have adequate labelling.
5 Check to make sure the housings are clean and tidy – for example, remove all wiring off-cuts.

11 Install the FC-FI/FC-FI-1 - field interface board

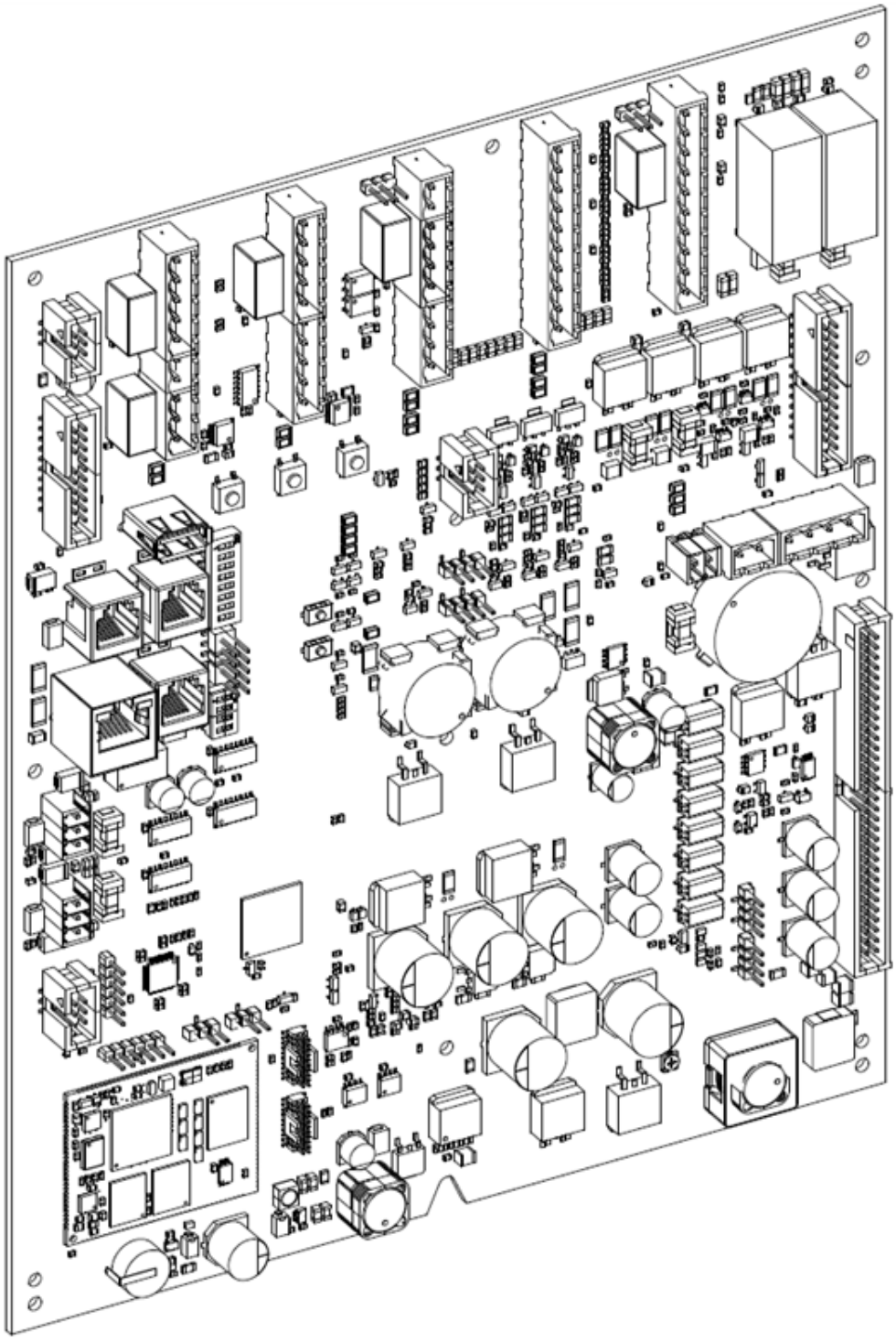

Fig. 17: FC-FI - Field Interface Board. The FC-FI is used in the FC604S and the FC604S Scandinavian panels.

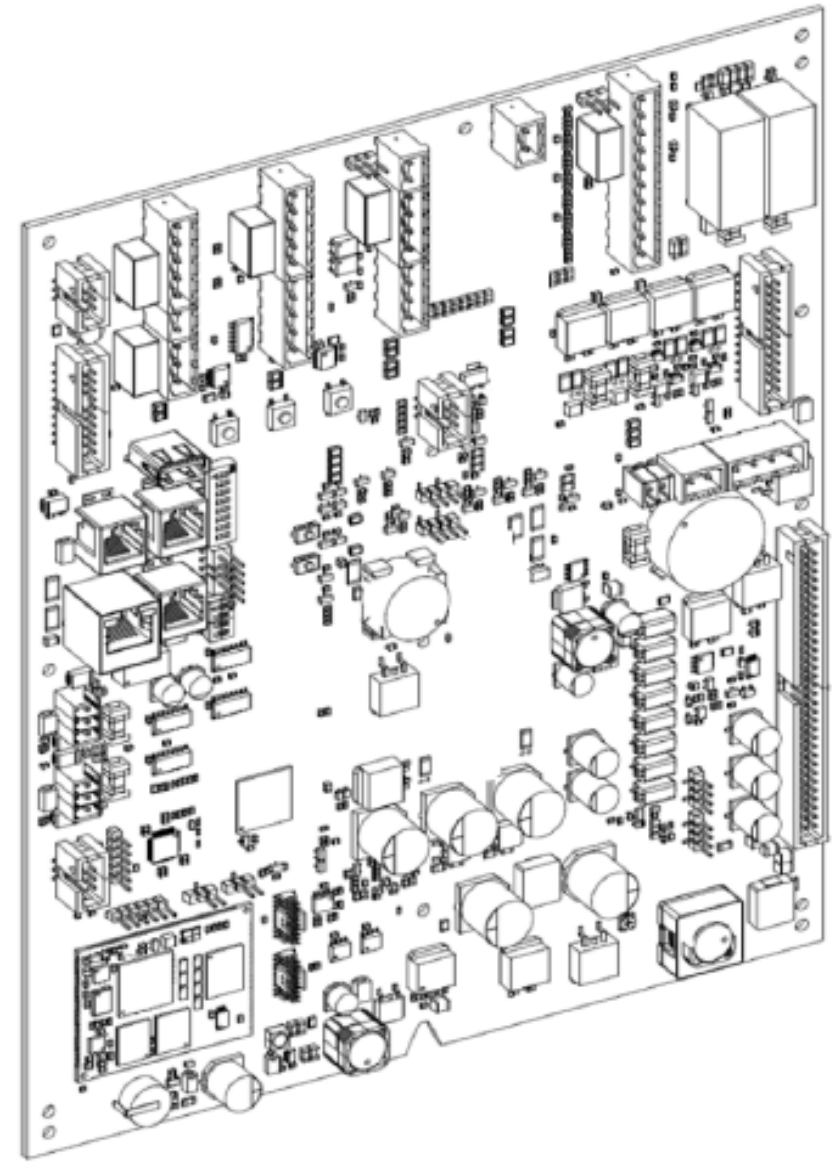

Fig. 18: FC-FI-1 - Field Interface Board. The FC-FI-1 is used in the FC602S and the FC602S Scandinavian panels.

11.1 Local FC-FI/FC-FI-1board connections

NOTICE

There is a danger of signal interference between cable runs.

Take care when laying out transmission lines to avoid the potential for cross-coupling between them.

11.2 Connecting local sounders

Local sounders are sounders connected directly to the FC-FI/FC-FI-1 board, as opposed to sounders on the addressable loop.

Connect the sounders as shown in Fig. 19 (Item 4). The figure only shows one sounder, but multiple sounders can be connected in parallel.

The terminating capacitors are included in the shipment. Fit the capacitors beyond the furthest sounder. The capacitors can be connected with either polarity. If a control panel sounder output is not required, connect the capacitor directly across the sounder output terminals.

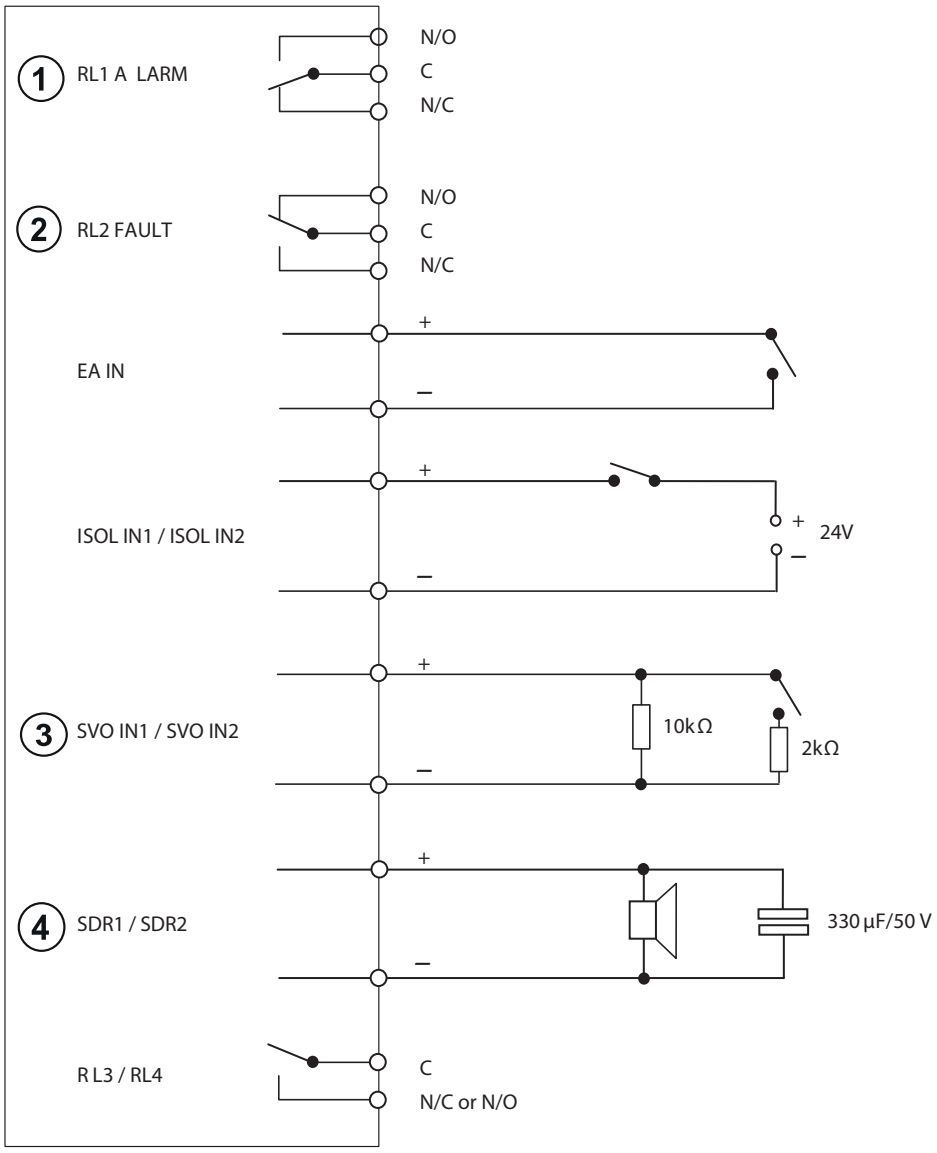

Fig. 19: FC-FI - Inputs and Outputs. The labels are as printed on the PCB.

1– ALARM relay. Shown in the "normal" position (no alarm).

2– FAULT relay. Shown in the "normal" position (no fault).

3– See Section "Connecting supervised inputs" on page 25.

4– See Section "" on page 24.

11.3 Connecting supervised inputs

The Supervised Input is active when the resistance applied between the input + and - terminals goes low. For example, when a shorting switch closes. Resistors are used to enable short and open circuit detection in the switch wiring.

Only connect to the Supervised Input if it is set up in the configuration.

Connect the switch using series and parallel resistors as shown in Fig. 19. The resistors are supplied. The switch must be externally sourced.

If you are not sure if the Supervised Input is used or not, connect the 'end of line' 10 kΩ resistor directly across the terminals. This will prevent a fault condition.

11.4 Checking the FC-FI/FC-FI-1 connections

The FC-FI connections are shown in Fig. 20. The FC-FI-1 connections are shown in Fig. 21. Not all of these are covered in this guide.

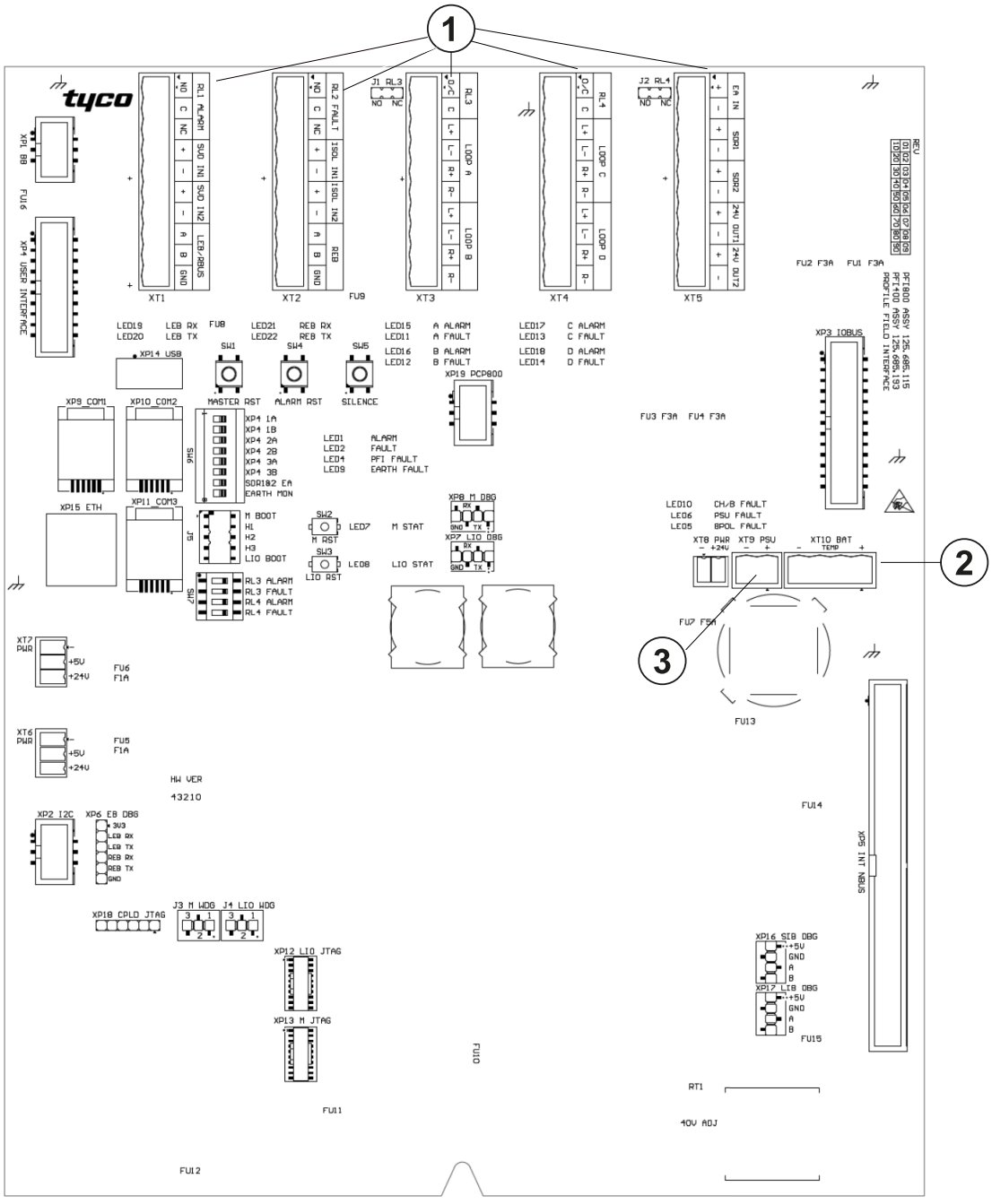

Fig. 20: FC-FI Connections

1– Loops, supervised input 1, supervised input 2, sounder, alarm and fault relay, 24V, emergency alarm (EA).

2– To the batteries. Marked 'XT10 BAT' on the PCB.

3– DC cable (black, twin conductor). Marked 'XT9 PSU' on the PCB.

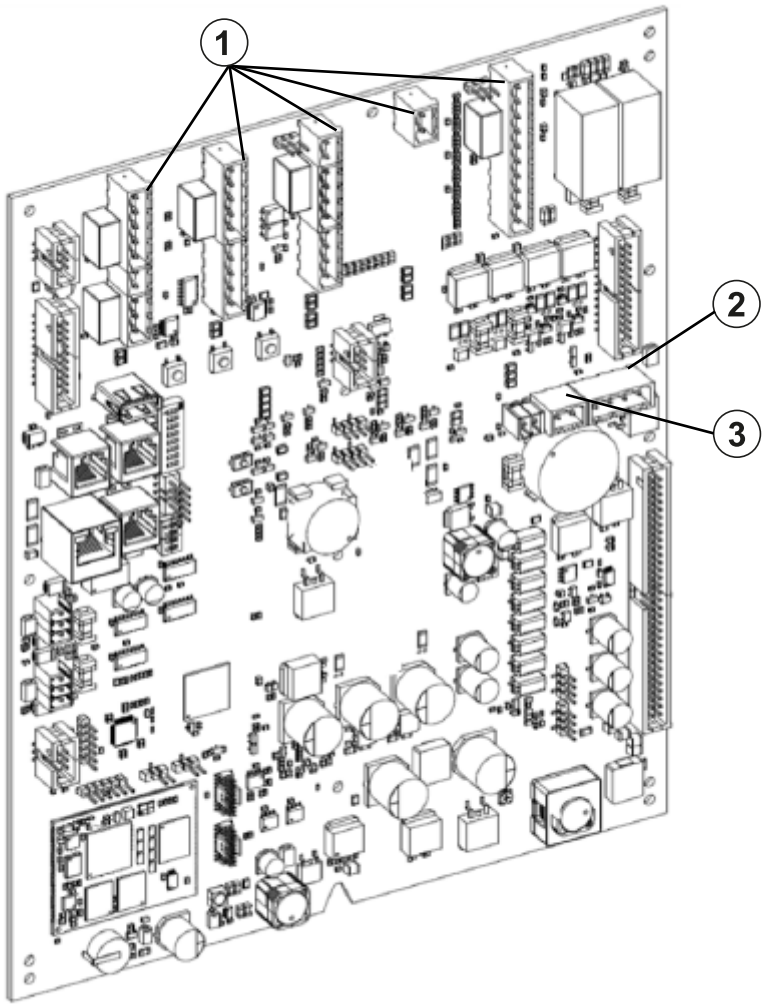

Fig. 21: FC-FI-1 Connections
1– Loops, supervised input 1, supervised input 2, sounder, alarm and fault relay, 24V, emergency alarm (EA).
2– To the batteries. Marked 'XT10 BAT' on the PCB.
3– DC cable (black, twin conductor). Marked 'XT9 PSU' on the PCB.

11.5 FC-FI/FC-FI-1 switches and jumper positions

The FC-FI and FC-FI-1 boards have connectors, jumpers and configuration switches. These are used, for example, when diagnosing problems and when configuring the board for additional modules. It is outside the scope of this installation guide to provide details of these. The factory settings are applicable in most situations. For more information, see the installation leaflets.

11.6 Jumper and DIP switch settings

Most jumpers and DIP switches on the GUI, the FC-FI/FC-FI-1 board and optional cards are already at the required settings as supplied. For example Debug mode is disabled, Boot mode is disabled, and so on. The default factory settings are marked by * in the following tables. Some special operational setting should be implemented under the specific project.

PCB Label	Function
SW1	Master RESET button

Table 5: FC-FI DIP Switches and Connector Functions

PCB Label	Function
SW2	MCPU RESET button
SW3	LIOMCU RESET button
SW4	Alarm RESET Button
SW5	Silence Button
SW6	See Table 8, 9 and 10.
SW7	See Table 11, 12, 13 and 14.
J1	See Table 7.
J2	See Table 7.
J3	See Table 7.
J4	See Table 7.
J5	See Table 7.
XT1	Terminals: Alarm Relay 1, Supervised Inputs 1 and 2, Left External N-Bus/R-Bus
XT2	Terminals: Fault Relay 2, Isolated Input 1, Isolated Input 2, Right External N-Bus/ R Bus
XT3	Terminals: Relay 3, Loop A, Loop B
XT4	Terminals: Relay 4, Loop C, Loop D (FC-FI only)
XT5	Terminals: Emergency Alarm Input, Sounder Output 1, Sounder Output 2, 24V Power Outp 1, 24V Power Output 2
XT6	Terminals: 24V and 5V Power for Third Party Cards
XT7	Terminals: 24V and 5V Power for Third Party Cards)
XT8	Terminals: 24V Power for FB800 15WAY Fuse Board
XT9	Terminals: PSU connection
XT10	Terminals: Battery and Battery Thermistor connection
XP1	Connector: Black Box front panel LEDs: Alarm, Fault, System Fault)
XP2	Connector: I2C interface and 5V Power
XP3	Connector: IO-Bus
XP4	Connector: to the internal CUI (colour user interface)
XP5	N/A

Table 5: FC-FI DIP Switches and Connector Functions

PCB Label	Function
XP6	Connector: External N-Bus for debugging
XP7	Connector: LIOMCU Debug port RS232
XP8	Connector: MCPU Debug port RS232
XP9	Connector: COM1- Printer, SM3, and third party interfaces
XP10	Connector: COM2- FC Express, FC Checker, and FC Remote
XP11	Connector: COM3 FCNET third party interfaces
XP12	Connector: Auxiliary JTAG for LIOMCU
XP13	Connector: Auxiliary JTAG for MCPU
XP14	Connector: USB interface
XP15	Connector: ETHERNET interface
XP16	Connector: Internal N-Bus Service Channel signals for debugging
XP17	Connector: Internal N-Bus Loop Channel signals for debugging
XP18	Connector: Auxiliary JTAG for CPLD
XP19	N/A

Table 5: FC-FI DIP Switches and Connector Functions

11.6.1 Configuration of a FC600 series panel RBus interface

The routing of the RBus is controlled by the DIP switches SW6:XP4 1A, SW6:XP4 1B, SW6:XP4 2A, SW6:XP4 2B, SW6:XP4 3A and SW6:XP4 3B. The switches are in pairs as the A and B lines of the RBus are switched separately.

The combination of these switches controls the routing of the RBus to the front door CUI or external devices.

The CUI and panel both have built in terminating resistors, so external terminating resistors should not be fitted to the panel. Table 6 shows all the switch combinations.

The recommended configurations, depending on what devices are connected to the RBus, are highlighted in grey in Table 6.

Refer to Fig. 22 to see the electrical layout of the switches.

Device	SW6: A XP4 1A	SW6: B XP4 1B	SW6: C XP4 2A	SW6: D XP4 2B	SW6: E XP4 3A	SW6: F XP4 3B
CUI	ON	ON	ON	ON	OFF	OFF
Black Box	OFF	OFF	ON	ON	OFF	OFF

Table 6: RBUS switches on FC-FI

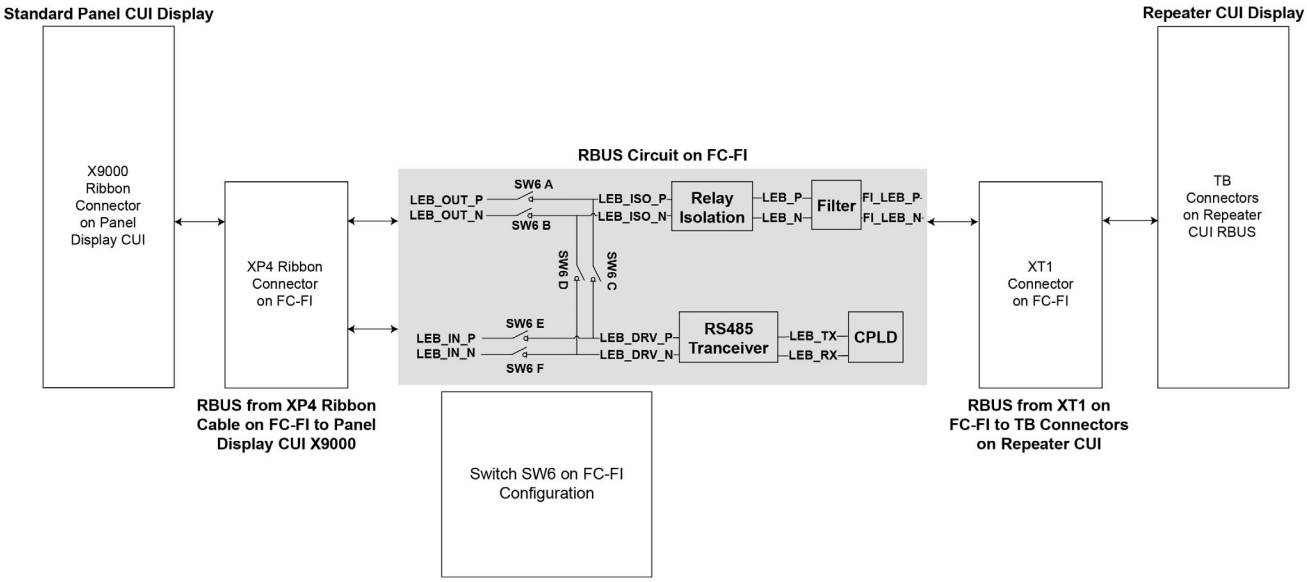

Fig. 22:RBUS communications link between the FC-FI and the standard CUI and repeater CUI

Jumper	1-2	2-3	OPEN
J1 – Relay 3	Normally Closed [1]	Normally Open	N/A
J2 – Relay 4	Normally Closed [1]	Normally Open	N/A
J3 – MCPU Watchdog	Enabled [1]	Active (MCPU in reset)	Enabled
J4 – LIOMCU Watchdog	Enabled [4]	Active (LIOMCU in reset)	Disabled
J5 – MCPU Boot Mode [2] ■ H1 Header ■ H2 Header ■ H3 Header ■ LIOMCU Boot Mode [3]	Enabled Enabled Enabled Enabled Enabled	- - - - -	Disabled [1] Disabled [1] Disabled [1] Disabled [1] Disabled [1]

Table 7: FC-FI/FC-FI-1 - jumper settings
[1] Default.
[2] For updating the MCPU Boot Loader. The mode is entered after an MCPU reset.
[3] For updating the LIOMCU firmware. The mode is entered after a LIOMCU rest. The LIOMCU Watchdog has to be disabled during update of firmware.
[4] Default. Disable this before a firmware update.

Header	Function
H1, H2, H3 not fitted	Standard operational mode or serial Configuration Download mode.
H1 fitted	-
H2 fitted	Clear the stored data when the panel is restarted.
H3 fitted	Panel configuration download from USB memory stick mode.

Table 8: FC-FI/FC-FI-1 - Header H1, H2, H3 functions

SW6 Position 7[1]	Sounders activated by External Alarm
OFF *	Disabled
ON	Enabled

Table 9: Sounders activated by emergency Alarm setting
** Default*
[1] The number 7 is located on the switch, not on the PCB.

SW6 Position 8[1]	Earth Fault Monitoring
OFF	Disabled
ON *	Enabled

Table 10: FC-FI/FC-FI-1 - Earth fault monitoring setting
** Default*
[1] The number 8 is located on the switch, not on the PCB.

SW7 Position 1	RL3 activated by ALARM
OFF *	Disabled
ON	Enabled

Table 11: FC-FI/FC-FI-1 - RL3 relay activated by ALARM setting
** Default.*

SW7 Position 2	RL3 activated by FAULT
OFF *	Disabled
ON	Enabled

Table 12: FC-FI/FC-FI-1- RL3 relay activated by FAULT setting
** Default.*

SW7 Position 3	RL4 activated by ALARM
OFF *	Disabled
ON	Enabled

Table 13: FC-FI/FC-FI-1 - RL4 relay activated by ALARM setting
** Default*

SW7 Position 3	RL4 activated by ALARM
ON	Enabled

Table 13: FC-FI/FC-FI-1 - RL4 relay activated by ALARM setting (cont.)
** Default*

SW7 Position 4	RL4 activated by FAULT
OFF *	Disabled
ON	Enabled

Table 14: FC-FI/FC-FI-1 - RL4 relay activated by FAULT setting
** Default*

Fuse number	Current	Voltage	Type
FU1	3A	125V	Bel Fuse 0679L3000 Littlefuse 0453003
FU2	3A	125V	Bel Fuse 0679L3000 Littlefuse 0453003
FU3	3A	125V	Bel Fuse 0679L3000 Littlefuse 0453003
FU4	3A	125V	Bel Fuse 0679L3000 Littlefuse 0453003
FU5	1A	125V	Bel Fuse 0679L1000 Littlefuse 0453001
FU6	1A	125V	Bel Fuse 0679L1000 Littlefuse 0453001
FU7	5A	125V	Bel Fuse 0679L5000 Littlefuse 0453005

Table 15: Characteristics of the FC-FI/FC-FI-1 changeable fuses

11.7 Changing a fuse on the FC-FI/FC-FI-1

The FC-FI/FC-FI-1 board has seven user changeable fuses. See Table 15 for more information.

CAUTION
Before you undertake this procedure, power down the panel by isolating the mains and removing the battery fuse.

To change fuses, complete these steps:

Note
Replacement fuses are not supplied. Purchase replacement fuses separately.

1 Identify the blown fuse on the board visually or by checking for continuity with a multimeter. Make sure that the fuse is one of the user replaceable fuses listed in Table 15.
2 Insert a screwdriver under the centre of the fuse and pull it out.
3 Check that the replacement fuse is of the correct current rating.
4 Put the replacement fuse on top of the connector, taking care that the current number is facing upwards, and press it down firmly.

DANGER
Ensure that the replacement fuse is of the correct current rating. Failure to insert the correct fuse can lead to injuries and damage to the equipment.
If the fuse is not listed in Table 15, it cannot be replaced. Send the board for repair.

12 Installing optional boards, cards and modules

The next step is to connect any optional boards, cards and modules into the system. These might include, for example:

- Cards such as a PNI800 Panel Net Interface card.
- Printers.
- Repeaters.

For an overview of stacked card mounting, see Fig. 24.

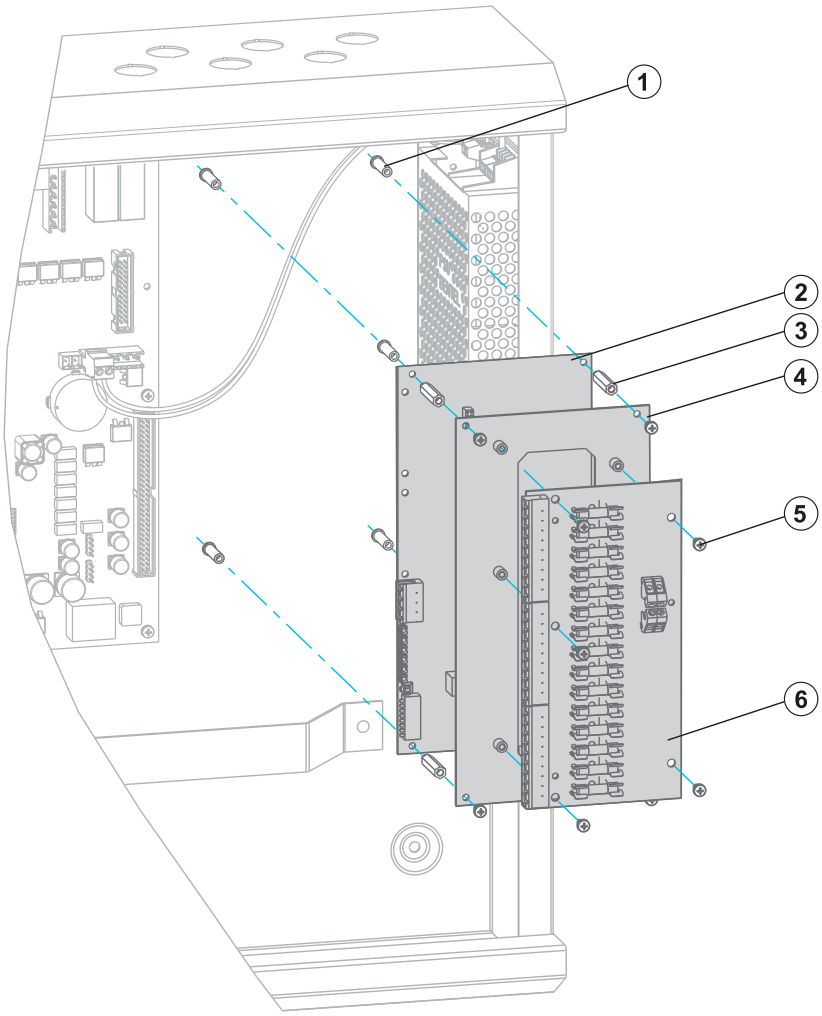

Fig. 23: Card installation in a stacked arrangement
1– Stand-offs
2– PNI800
3– Pillars
4– Old cards adapter
5– M3 screws
6– FB800

12.1 Obtaining card addresses

When you install cards as described in later sections of this guide, you may need to set the addressing DIP switches of these cards.

Here is an example of how to obtain the address to set:

1 Start the configuration software, for example, FireClass Express.
2 Open the system configuration.
3 Go to 'Point Regions'.
4 Find the 'Card' entries in the list.
5 Find an address number that is populated with the type of card you are installing.
6 Make sure this number has not already been allocated – you might have to read the DIP switch settings of already installed cards.For example, the PNI800 card address number is 2.
7 If the number is available, note this to be set on the card's DIP switch, as covered in a later section below.

12.2 Card arrangement planning

To even out the current flow, plan a stacked card arrangement similar to the one shown in Fig. 23. If fitting a PNI800 card, fit this first so that it is at the back of the group of cards. Other cards require more connections and it is easier to plug in cables if they are fitted towards the front of a group of cards.

12.3 Mounting cards and boards on a FC600 series panel

You can mount the PNI800 card and the FB800 board on the FC600 series panel in a stacked arrangement using the pillars, washers and nuts that are supplied with the card or board. A maximum of three cards or boards can be fitted. Make sure that you fit the larger items (such as the PNI800) before smaller ones (such as the FB800).The old cards holder (120.008.130) is supplied with the optional P-EXP Panel Expansion Kit (557.202.807). Refer to Fig. 23 and complete these steps:

1 The larger type of cards or boards are supplied with a plastic bezel that must be removed in this arrangement. To do this, remove the two self-tapping screws that secure this part.
2 If fitting the PNI800, connect the larger 64way connector of the ribbon cable to XP5 INT NBUS on the FC-FI/FC-FI-1. Lead the cable across the mounting plate at the back of the housing toward the PSU. Position the cable so that it is not trapped between the mounting pillars and the PCB.
3 Put the first board on top of the pillars provided (item 1 in Fig. 23). Secure the card using washers and screws if this is the only card being used, or a pillar, if you are inserting more cards or boards.
4 If fitting a PNI800, connect the 50way connector closest to the FC-FI/FC-FI-1 to the connector on the PNI800 PCB. If you fit a second card of this type, use the next 50way connector.

13 Installing the PNI800 - Panel Net Interface

Install any PNI800 cards by completing these steps:

1 Check whether the card needs a firmware upgrade and if so, refer to the relevant Technical Information Bulletin (TIB).
2 Obtain an address number to set on the card's addressing DIP switch – see Section "Obtaining card addresses" on page 32. For the PNI800, the address number is 2 and there can be a maximum of one PNI800 fitted.
3 Set the addressing DIP switches to the address number. For a settings look up chart see Table 38 on page 36.
4 Attach stand-offs to the back of the panel housing (see item 1 in Fig. 23).
5 Mount the PNI800 on to the stand-offs.
6 Connect all necessary cables to the PNI800. See section 12.3 Mounting Cards and Boards on a FC600 series panel.
7 When the panel is powered up, check the optical indicators to ensure correct operation.

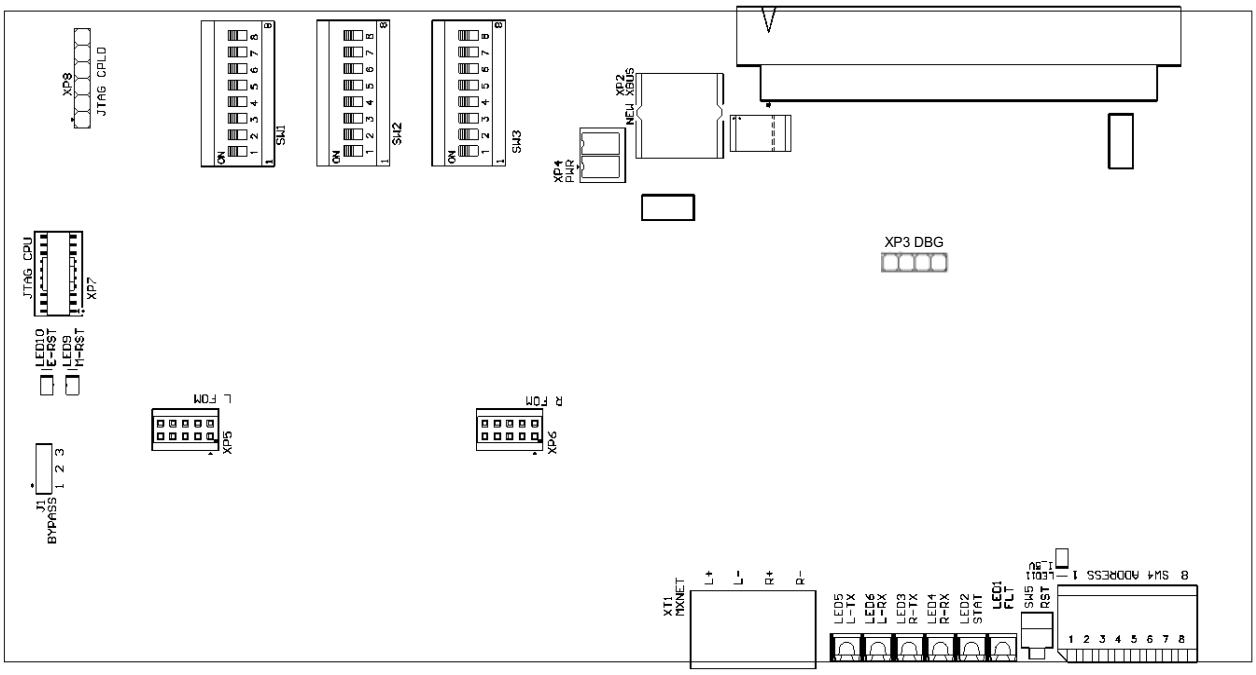

Fig. 24: PNI800 - Jumper, switch and terminal positions

Item	Function
J1	See Table 17.
SW1	See Table 18, 19, 20, and 21.
SW2	See Table 22, 23, 24, and 24.
SW3	See Table 26 and 27.
SW4	See Table 28. DIP switch (Internal N-BUS address)
SW5	Reset button
XT1	FC NET connector
XP1	Backplane (Internal N-BUS) connector
XP2	Auxiliary Zonal LED panel connector (e.g. for PNI800 in box)
XP3	Debug Port (RS232) connector
XP4	Auxiliary power supply connector (e.g. for PNI800 in box)
XP5	Left fibre optic module
XP6	Right fibre optic module
XP7	Auxiliary JTAG port for CPU
XP8	Auxiliary JTAG port for CPLD

Table 16: PNI800 - Jumper, switch and terminal functions

Jumper	1-2	2-3
J1Bypass	Normal Mode*	Node Bypassed[2]

Table 17: PNI800 - J1 jumper setting
** Default.*
[2] The FC-Network left and right channels are hardware-connected. Set this only if the PNI800 card is non-operational (due to a fault or not being powered up for example).

SW1 Position		Application
1	2	
OFF	OFF	Gateway*
ON	OFF	Bridge
ON	ON	Hub
OFF	ON	Reserved

Table 18: PNI800 - Application setting
**Default*

SW1 Position			Network Baud Rate
3	4	5	
ON	ON	ON	9600
OFF	ON	ON	19200
ON	OFF	ON	38400
OFF	OFF	ON	57600
ON	ON	OFF	76800
OFF	ON	OFF	115200*
ON	OFF	OFF	Reserved
OFF	OFF	OFF	Reserved

Table 19: PNI800 - Network baud-rate setting
** Default.*

SW1 Position 6	Network Topology
ON	BUS
OFF	RING*

Table 20: PNI800 - Network Topology setting
** Default.*

SW1 Position 8	MAIN MCU FW upgrade mode
ON	Enabled. Mode is activated after RESET
OFF	Disabled*

Table 21: PNI800- Main MCU FW upgrade mode enable
**Default*

SW2 Position 1	Host Interface
ON	RS232
OFF	NBUS*

Table 22: PNI800 - Host Interface setting
** Default.*

SW2 Position 2	Emergency Display
ON	Enabled
OFF	Disabled*

Table 23: PNI800 - Emergency Display setting
** Default.*

SW2 Position			Network Left and Right Terminator
3	4	5	
OFF	OFF	OFF	Left and Right Enabled* (default)
OFF	ON	OFF	Left Disabled
OFF	OFF	ON	Right Disabled
OFF	ON	ON	Left and Right Disabled
ON	OFF	OFF	Reserved
ON	OFF	ON	Reserved
ON	ON	OFF	Reserved
ON	ON	ON	Reserved

Table 24: PNI800 - Panel Net Interface Terminator setting for metal cable
** Default setting in normal operation for Bus and Ring network topology*

SW2 Position 8	Emergency MCU FW Upgrade Mode
ON	Enabled. Mode is activated after RESET
OFF	Disabled*

Table 25: PNI800 Panel Net Interface - Emergency MCU FW upgrade mode enable
** Default.*

SW3 Position 1 to 7	Network address
ON	Binary coded network address SW 3.1=LSB SW 3.7=MSB ON=1 OFF=0
OFF	

Table 26: Network Address Setting

SW3 Position 8	Test Mode
ON	Enabled
OFF	Disabled*

Table 27: PNI800 - Test Mode setting
** Default.*
***Note:** The Test Mode setting is only enabled for factory test purposes.*

SW4 Position 1 to 7	NBUS address
ON	Binary coded NBUS address SW 4.1=LSB SW 4.7=MSB ON=1 OFF=0
OFF	

Table 28: PNI800 - NBUS address setting

SW4 Position 8	Mode
ON	Commissioning Mode

Table 29: PNI800 - Mode setting

13.1 Changing a fuse on the PNI800 Panel Net Interface

CAUTION
Before you undertake this procedure, power down the panel by isolating the mains and removing the battery fuse.

The PNI800 has two fuses. Only one of the fuses is user replaceable. See Table 30 for more information.

Fuse number	Current	Voltage	Type
FU1	0.5A	125V	SSTC500

Table 30: User changeable fuse on a PNI800

To replace the FU1 fuse, complete these steps:

Note
Replacement fuses are not supplied. Purchase replacement fuses separately.

1 Identify the blown FU1 fuse on the card visually or by checking for continuity with a multimeter.
2 Insert a screwdriver under the centre of the fuse and pull it out.
3 Check that the replacement fuse is of the correct current rating.

4 Put the replacement fuse on top of the connector, taking care that the current number is facing upwards, and press it down firmly.

DANGER

Make sure that the replacement fuse is of the correct current rating. Failure to insert the correct fuse can lead to injuries and damage to the equipment.

If fuse FU2 needs replacing, send the board for repair.

14 Mounting a FB800 15WAY fuse board on a FC600 series panel

Note

Before you undertake this procedure, power down the panel by isolating the mains and removing the battery fuse.

1 Unplug any cards or boards that are already fitted.
2 Note the positions of the cables connected to the cards or boards.
3 Refer to section 12.3 Mounting cards and boards on a FC600 series Lite panel and Fig. 23. Mounting the FB800 board requires the use of an old cards adapter bracket (120.008.130) from the optional P-EXP Panel Expansion Kit (557.202.807), item 5 in Fig. 23.
4 Attach the old cards adapter to the existing cards using pillars (items 3 in Fig. 23). Secure with M3 x 6mm screws (items 6 in Fig. 23).
5 Mount the FB800 board on to the old cards adapter using M3 x 6mm screws and washers.
6 Connect all necessary cables to the FB800 board.

14.1 FB800 15WAY fused 24V outputs board details

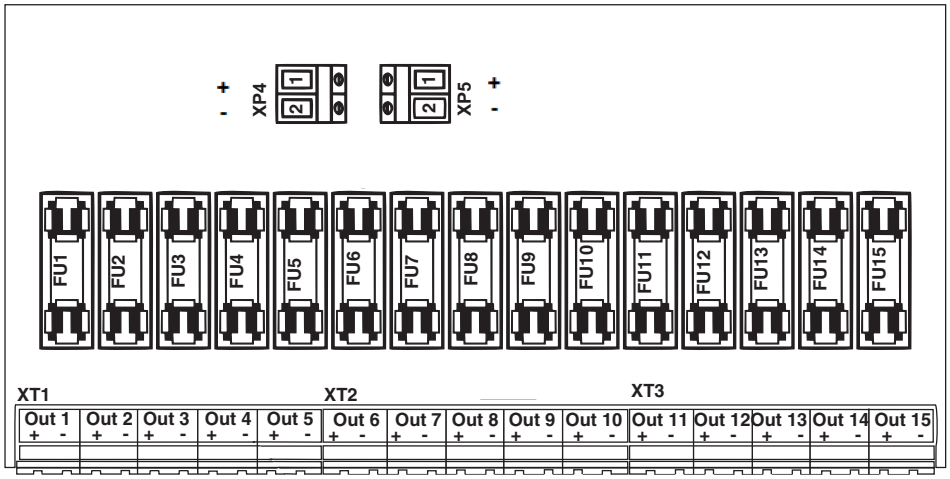

Fig. 25: FB800 terminal positions

Connector	Function
XT1	Power 24V fused Outputs 1 to 5
XT2	Power 24V fused Outputs 6 to 10
XT3	Power 24V fused Outputs 11 to 15

Table 31: FB800 Terminal Functions

Connector	Function
XP4	Power 24V Input
XP5	Power 24V Output

Table 31: FB800 Terminal Functions

15 Installing the CSG Connected Services Gateway

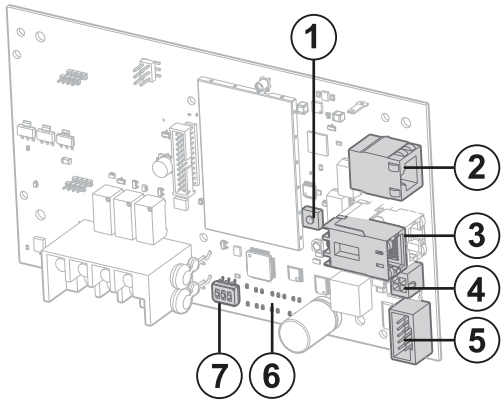

Fig. 26: Connected Services Gateway module

Callout	Description
1	Reset switch
2	LAN Ethernet: connects to the building LAN **Note:** Use a Cat 6 shielded Ethernet cable.
3	Panel-side Ethernet half: fire panel side Ethernet ports: connects to fire panel
4	4-pin power connector
5	Serial port (not used)
6	Status LEDs
7	Configuration DIP switches (not used)

Mounting boards on the FC600 panel

1 Attach an A16381TMRV mounting plate, item 2 in Fig.27, to the pillars in the CIE case using five M3 screws, item 3. If there are other cards in the stack, they might also need the M3 x 25 pillars.

2 Attach the CSG PCBA, item 4, to the plate using M3 screws, item 3.

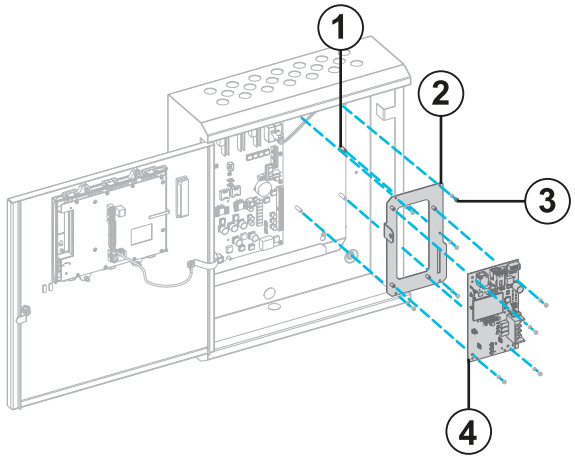

Fig. 27: Mounting boards on a FC602S panel

Callout	Description
1	Mounting pillars in the CIE case
2	A16381TMRV mounting plate
3	M3 screws and washers
4	CSG PCBA

15.1 Optional: Mounting the cellular module and antenna

If you use the optional cellular module, consult the *Connected Services Gateway Cellular Module and Antenna Installation Instructions 579-1459* for mounting instructions. Do this before you connect the CSG to the fire alarm control panel.

15.2 Connecting the CSG to the fire alarm control panel using an Ethernet connection

Connect the CSG to the fire alarm control panel using the Ethernet port or, if the Ethernet port is in use, an Ethernet switch.

For an Ethernet port, complete the following steps:

1 Insert the Ethernet cable into the panel-side Ethernet half of the CSG.

2 Insert the other end of the Ethernet cable into the RJ45 Ethernet port on the CPU card of the fire alarm control panel.

For an Ethernet switch, complete the following steps:

1 Ensure that a fire-approved Ethernet switch is installed inside the fire alarm control panel.
2 Connect the Ethernet switch to the Ethernet port of the fire alarm control panel.
3 Use another Ethernet cable to connect the panel-side Ethernet half of the CSG to a port on the Ethernet switch.

15.3 Connecting the CSG to the power supply

The CSG is powered through the power harness included with the product. To connect the CSG to the power supply, complete the following steps:

1 Connect the power harness to the 4-pin power connector on the CSG. See item 4 in Fig. 26.
2 Connect the other end of the power harness to the fire alarm control panel 24 V supply by following the wire sequence red wire to panel 24 V supply and black wire to 0 V.

Notes

- The CSG takes a high inrush current when hot-plugged and can blow a 1 A fuse. This means, for example, that connectors XT6 and XT7 on the FC-FI are not suitable. The 24V OUT 1 and 2 outputs on the FC-FI field connectors are suitable.
- Trim off any excess cable from the unterminated end of the power cable. Do not coil up and tie off excess cable in the CSG housing.

15.4 Optical indicators

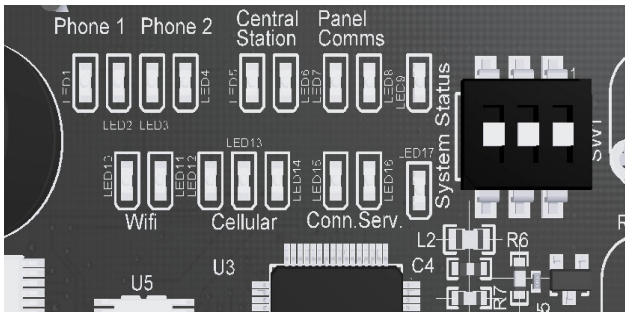

Fig. 28: Location of the LEDs on the CSG

Status	Green LED	Red LED
No power	Off	Off
Power connected: software not running; Manual reset; System failure	On	On
Power connected: software booting or restarting	On	Off
Normal: CSG application running	Blinking	Off

Table 32: System status LEDs

Status	Green LED	Yellow LED
Normal: connected to the fire panel	On	Off
Not connected to the fire panel	Off	On
Mismatch	Off	Blinking

Table 33: Fire alarm control panel communication LEDs

Status	Green LED	Yellow LED
Normal: connected to the enterprise server	On	Off
Not connected to the enterprise server, connected to an external network only	Off	Blinking
Not connected to an external network	Off	On
Failure or error	Blinking	Blinking
Disabled	Off	Off

Table 34: LAN connection LEDs

Status	LED behaviour
Link up	On
Activity	Blinking
Not connected	Off

Table 35: Ethernet port LED

Status	Green LED 1	Green LED 2	Yellow LED
High quality signal	On	On	Off
Moderate quality signal	On	Blinking	Off
Low quality signal	On	Off	Off
Very poor quality signal	Blinking	Off	Off
Not connected	Off	Off	Blinking
Fault or error	Off	Off	On
Disabled	Off	Off	Off

Table 36: Cellular LEDs

16 Binary DIP switch lookup tables

The following tables show the binary equivalents of decimal numbers, with the binary most significant bit on the right.

Dec	Position 1.....8
0	00000000
1	10000000
2	01000000
3	11000000
4	00100000
5	10100000
6	01100000
7	11100000
8	00010000
9	10010000
10	01010000
11	11010000
12	00110000
13	10110000
14	01110000
15	11110000
16	00001000
17	10001000
18	01001000
19	11001000
20	00101000
21	10101000
22	01101000
23	11101000
24	00011000
25	10011000
26	01011000
27	11011000
28	00111000
29	10111000
30	01111000
31	11111000
32	00000100
33	10000100
34	01000100
35	11000100

Dec	Position 1.....8
36	00100100
37	10100100
38	01100100
39	11100100
40	00010100
41	10010100
42	01010100
43	11010100
44	00110100
45	10110100
46	01110100
47	11110100
48	00001100
49	10001100
50	01001100
51	11001100
52	00101100
53	10101100
54	01101100
55	11101100
56	00011100
57	10011100
58	01011100
59	11011100
60	00111100
61	10111100
62	01111100
63	11111100
64	00000010
65	10000010
66	01000010
67	11000010
68	00100010
69	10100010
70	01100010
71	11100010
72	00010010

Dec	Position 1.....8
73	10010010
74	01010010
75	11010010
76	00110010
77	10110010
78	01110010
79	11110010
80	00001010
81	10001010
82	01001010
83	11001010
84	00101010
85	10101010
86	01101010
87	11101010
88	00011010
89	10011010
90	01011010
91	11011010
92	00111010
93	10111010
94	01111010
95	11111010
96	00000110
97	10000110
98	01000110
99	11000110
100	00100110
101	10100110
102	01100110
103	11100110
104	00010110
105	10010110
106	01010110
107	11010110
108	00110110
109	10110110
110	01110110
111	11110110

Dec	Position 1.....8
112	00001110
113	10001110
114	01001110
115	11001110
116	00101110
117	10101110
118	01101110
119	11101110
120	00011110
121	10011110
122	01011110
123	11011110
124	00111110
125	10111110
126	01111110
127	11111110
128	00000001
129	10000001
130	01000001
131	11000001
132	00100001
133	10100001
134	01100001
135	11100001
136	00010001
137	10010001
138	01010001
139	11010001
140	00110001
141	10110001
142	01110001
143	11110001
144	00001001
145	10001001
146	01001001
147	11001001

Dec	Position 1.....8
148	00101001
149	10101001
150	01101001
151	11101001
152	00011001
153	10011001
154	01011001
155	11011001
156	00111001
157	10111001
158	01111001
159	11111001
160	00000101
161	10000101
162	01000101
163	11000101
164	00100101
165	10100101
166	01100101
167	11100101
168	00010101
169	10010101
170	01010101
171	11010101
172	00110101
173	10110101
174	01110101
175	11110101
176	00001101
177	10001101
178	01001101
179	11001101
180	00101101
181	10101101
182	01101101
183	11101101
184	00011101
185	10011101
186	01011101

Dec	Position 1.....8
187	11011101
188	00111101
189	10111101
190	01111101
191	11111101
192	00000011
193	10000011
194	01000011
195	11000011
196	00100011
197	10100011
198	01100011
199	11100011
200	00010011
201	10010011
202	01010011
203	11010011
204	00110011
205	10110011
206	01110011
207	11110011
208	00001011
209	10001011
210	01001011
211	11001011
212	00101011
213	10101011
214	01101011
215	11101011
216	00011011
217	10011011
218	01011011
219	11011011
220	00111011
221	10111011
222	01111011
223	11111011
224	00000111
225	10000111
226	01000111

Dec	Position 1.....8
227	11000111
228	00100111
229	10100111
230	01100111
231	11100111
232	00010111
233	10010111
234	01010111
235	11010111
236	00110111
237	10110111
238	01110111
239	11110111
240	00001111
241	10001111
242	01001111
243	11001111
244	00101111
245	10101111
246	01101111
247	11101111
248	00011111
249	10011111
250	01011111
251	11011111
252	00111111
253	10111111
254	01111111
255	11111111

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