Multifunction Protection and Switchgear Control Unit

Model REF542*plus*

Operator's Manual

Industrial IT enabled™

ABB

Table of Contents

1 About this manual

1.1 Read it first!

Before attempting any operation with the REF542*plus*, read carefully this manual first.

This manual describes how to use the interface of the REF542*plus* (LD HMI, Local Detached Human Machine Interface). Please note that HMI views and pictures are to be considered exemplary.

This manual is addressed to field personnel and to anyone who needs to interact with REF542*plus* from its HMI.

1.2 Industrial^{IT}

This product has been tested and certified as Industrial IT Enabled. All product information is supplied in interactive electronic format, compatible with ABB Aspect Object^{TM} technology. The Industrial^{IT} commitment from ABB ensures that every enterprise building block is equipped with the integral tools necessary to install, operate, and maintain efficiently throughout the product lifecycle.

Detailed information on Industrial^{IT} is available at <http://www.abb.com/industrialit>.

1.3 Document information

Revision History

Version	Date	Note
1VTA100172-Rev 1, en	01.11.2002	First release
1VTA100172-Rev 2, en	22.10.2003	Updated to version 4D02
1VTA100172-Rev 3, en	03.05.2004	Updated
1VTA100172-Rev 4, en	04.04.2005	Updated

Applicability

This manual is applicable to REF542*plus* Release 2.0, software version V4D02.

2 Safety Information

There are safety warnings and notes in the following text. They are in a different format to distinguish them from normal text.

Safety warning

The safety warnings should always be observed. Non-observance can result in death, personal injury or substantial damages to property. Guarantee claims might not be accepted when safety warnings are not respected. They look like below:

Warning!

Do not make any changes to the REF542*plus* configuration unless you are authorized to do that and you are familiar with the REF542*plus* and its Operating Tool. This might result in disoperation and loss of warranty.

Note

A note contains additional information worth noting in the specific context, and looks like below:

Note

The selection of this control mode requires caution, because operations are allowed both from the HMI and remotely.

3 Abbreviations and Definitions

3.1 Abbreviations

LD HMI	**L**ocal **D**etached **H**uman **M**achine **I**nterface
HMI	**H**uman **M**achine **I**nterface
RHMI	the same as HMI
LCD	**L**iquid **C**rystal **D**isplay
SLD	**S**ingle **L**ine **D**iagram
Led	**L**ight **E**mitting **D**iode
GPS	**G**lobal **P**ositioning **S**ystem
Scada	**S**upervision, **C**ontrol and **D**ata **A**cquisition
CT	**C**urrent **T**ransformer
VT	**V**oltage **T**ransformer
SI	**S**ensor **I**nput
FUPLA	FUnctional Programming Language. The graphical language to program the REF542*plus*.
PC	Personal Computer

3.2 Definitions

Operational State	the unit is active and it is protecting and controlling the switchgear.
Stand-alone	the unit is not connected to a Scada system.

4 HMI Features

The REF542*plus* HMI is shown in the picture below. The HMI features a back-illuminated LCD, 8 push buttons, several leds and an electronic key sensor. The language of the display, when available, can be selected via the Operating Tool.

Figure 1: REF542*plus* HMI.

The LCD in the SLD view provides a graphical representation of the primary objects controlled or monitored by the REF542*plus* in the switchgear. The right half of the LCD is for plain text visualization such as measurements and protection events. The contrast level is automatically controlled for an optimum reading, it can be also adjusted as desired.

The HMI panel is organized in three main areas.

Control area

The left side of the HMI panel is for primary objects control. The command buttons and the information related to the switchgear control are placed on this area.

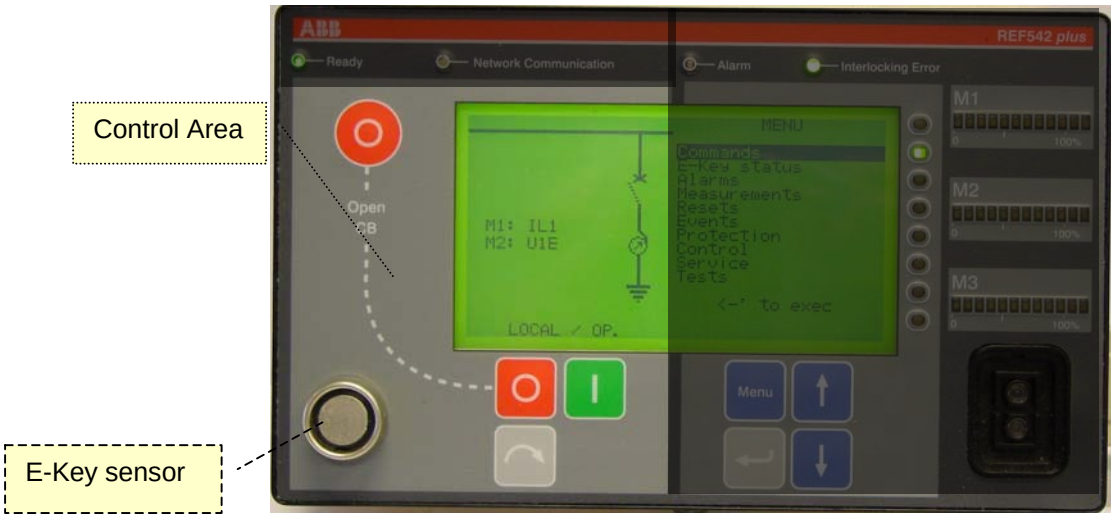


Figure 2: HMI control area.

This section of the LCD display shows the Single Line Diagram of the controlled panel and the measurement bars meaning. Text can be added in this section to improve the understanding of the SLD.

- **Command buttons**

Primary Object Control. These push buttons allow operating the primary objects configured as "selectable".

The command push buttons for local operation of the switching devices are:

Open, to open the selected object, < **O** > later in text.

Close, to close the selected object, < **I** > later in text.

Select, to select the object, < ↘ > later in text. The selected object appears highlighted.

CB Fast Opening. When pressed simultaneously with the normal open button, this button allows opening the circuit breaker, independently from the selected control mode. This feature must be enabled in the unit with the Operating Tool.

- **E-Keys Sensor**

This is the sensor for the electronic keys. The sensor automatically detects which key has been inserted. The two keys are usually labeled "Protect" and "Control", to distinguish them.

Protection key: is specialized to the protection environment, allowing changing of parameters and other functions related to the protection.

Control Key: is specialized to the control modes. This allows changing the operating mode of the REF542*plus*. The different operating modes discipline the access to the primary objects by the different REF542*plus* interfaces (HMI and SCADA).

When required, a SuperUser key to access both modes can be provided. The Superuser key is also needed to access the commissioning test mode.

The password codes stored in the key can be customized in each REF542*plus* for access restriction purposes.

- **SLD view**

This is the graphical part of the LCD. This part shows the single line diagram of the switchgear. The status of the primary objects is dynamically updated after every operation: if for example the circuit breaker has been opened, its representation will reflect it.

Info and Menu area

The right side of the HMI LCD is for information and menu browsing. The buttons to navigate through the menus and to change items are placed in this area.

Figure 3: Info and menu area.

- **Menu Navigation**. These push buttons allow navigating trough the REF542*plus* menus.

  Menu Pressing this button, < **Menu** > later in text, the unit goes back to the former menu.

 The up direction push button, < ↑ > later in text.

 The down direction push button, < ↓ > later in text.

 The enter push button, **< <-' >** later in text, to enter into the selected menu or to select the highlighted sub menu.

The following menus are available in the main window:

- **Commands**: This menu shows the configured FUPLA commands.
- **E-Key status**: to display and change the unit modes with the electronic keys.
- **Alarms**: it displays the indication leds status.
- **Measurements**: it displays the available measurements.
- **Resets**: to acknowledge alarms and other quantities.
- **Events**: to display protection starts and trips events.
- **Protection**: it displays the protection functions installed in the unit, and allows displaying and changing their settings.
- **Control**: it displays the control functions list installed in the unit, and allows to displaying and changing their settings.
- **Service**: Relevant information on the HW and SW configuration and basic setting of the REF542*plus*.
- **Tests**: to access the test mode for the HMI and the primary objects.

 Note

Access to a few submenus is allowed only in some modes.

- **Led bars**

Three led bars are available to show the most relevant measurements acquired by the REF542*plus,* for a quick inspection of the switchgear load situation. The three bars are marked M1, M2, and M3. Each bar is composed of twelve leds: ten green and two red. The ten green leds are normally dedicated to display between 0% and 100% of the nominal value of the configured measurement, each led corresponding then to 10% of the nominal value. The two red leds indicate an overload condition of 20%. The measurements displayed by the bars are set with the Operating Tool.

- **Indication leds**

8 x 4 pages user programmable leds. 8 freely programmable, three-color leds are available for indications. There are 4 pages of these leds. As a result, a total of 32 indication options can be programmed for events and status regarding protection, control, monitoring, binary inputs, etc. The assignment of the led to a specific condition is done with the Operating Tool.

- **Optical interface**

This is the optical serial interface port to connect the REF542*plus* to a personal computer. By using the appropriate cable and the Operating Tool, the following actions are possible:

- Download a configuration into the unit.
- Upload the current configuration from the unit.
- After a fault, upload the fault recorder data. This is possible only if the fault recorder has been previously enabled with the Operating Tool.

Upload other information (measurements, binary inputs status, binary output status).

Warning!

Do not make any changes to the REF542*plus* configuration unless you are familiar with the REF542*plus* and the Operating Tool. This might result in disoperation and loss of warranty.

REF542*plus* status information area

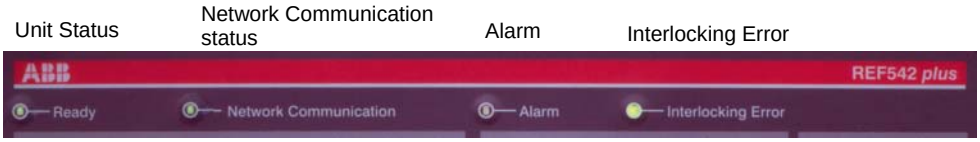


Figure 4: Status Information area.

The HMI shows the following status information :

- **Ready**. This green led is turned on when the unit is in the operational state. This led is switched off when the auxiliary power is not present or when the unit is not operational (FUPLA is not running).
- **Network Communication**. This led is meaningful only when the REF542*plus* is equipped with a communication module. When a communication module is detected the led turns on, if the module is not detected or fails the led turns red. When a Modbus communication module is installed, the led becomes orange if the communication error rate increases. It becomes red when the communication error rate prevents a good communication. The led comes back to green when no communication errors occur or by resetting the module status registers (see the Modbus technical reference). When there is no communication module, this led is always switched off.
- **Alarm**. This led turns to red when user defined alarms become true. Several arbitrary alarm conditions can be defined and configured with the Operating Tool. Alarm conditions could be the trip of a protection function, loss of SF6 in the circuit breaker, etc. When this led is on, it is not possible to close the circuit breaker or to download a new configuration. The alarm must be acknowledged first.
- **Interlocking Error**. This led is usually green. It turns temporarily to red when the user attempts an operation that would violate the programmed interlocking conditions; for example switching a disconnector with the circuit breaker in closed position.

5 Behavior at power up

Warning!

Before energizing the switchgear, verify that the REF542*plus* protection functions are properly set and that the unit is properly working (READY Led green).

At power up, the HMI unit shows on the LCD for a few seconds the following:

Figure 5: REF542*plus* LCD during power up.

After that, the LCD left part shows the switchgear single diagram while the right part shows the default menu. When the initialization is completed and the unit is operational, the ready led is on.

6 Control modes

6.1 Available control modes

Local Control:

It is possible to control the circuit breaker and other primary objects from the HMI, using the object control buttons. Open and close operations are possible only if the interlocking logic programmed into the unit allow them. Remote control from the Scada is inhibited. Uploading and downloading of the configuration via the optical interface is possible.

Remote Control

The control of the circuit breaker and other primary objects from the HMI is inhibited. The control is possible only remotely. Uploading and downloading of the configuration via the optical interface is possible.

No Control

It is not possible to control the circuit breaker and other primary objects both from the HMI and remotely. Any kind of operation, apart from protection trip, is inhibited. Uploading and downloading of the configuration via the optical interface is possible.

Local and Remote Control

Both local control from HMI and remote control are possible. Uploading and downloading of the configuration via the optical interface is possible.

Note

The selection of this control mode requires caution, because operations are allowed both from the HMI and remotely.

6.2 Changing the control modes

The next figure shows how to change the control mode. At first the menu E-Key must be selected. Then the control key must be placed in the electronic key sensor.

Select then the desired control mode using UP <↑> and DOWN <↓> until it is highlighted. Confirm the selection pressing ENTER **<↵>**. After having pressed ENTER **<↵>**, the E-key status menu will appear again. Verify that the required control mode has been properly set in the unit looking in the lower left corner of the HMI. A text string there indicates the currently selected control and protection mode.

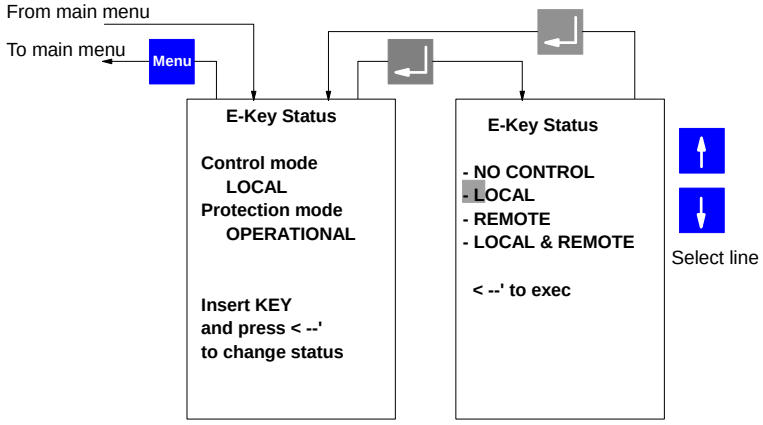


Figure 6: Changing the control mode using the control key.

7 Operating the Primary Objects

The primary objects can be operated from the HMI when the selected control mode is local or local and remote. The Object control push buttons allow operating the primary objects.

Press < ↘ > to step through the available objects until the desired object is selected (it will appear highlighted in the SLD). The object remains highlighted until the open or close push button is pressed or the time-out has elapsed.

Press < **O** > to open the selected object.

Press < **I** > to close the selected object.

Note

Only primary objects directly controlled by the REF542*plus* can be selected. For example, the REF542*plus* will show the correct position of a manual disconnect switch after an operation, but it will not be possible to select it.

8 Viewing and resetting alarms

8.1 Viewing Alarms

The presence of an alarm, when latched, is indicated by the alarm led turned on or by one of the 8 x 4 pages user programmable leds turned on to red. The conditions or the events that generate an alarm are defined and programmed with the Operating Tool.

When an alarm is active, the corresponding led is turned on to red. Select the alarm menu with the navigation buttons. Then this menu displays the text associated to the alarm condition. The displayed text is defined with the Operating Tool.

There are four pages of alarms, and each page reports at most eight alarms. Use the navigation button to browse trough the pages.

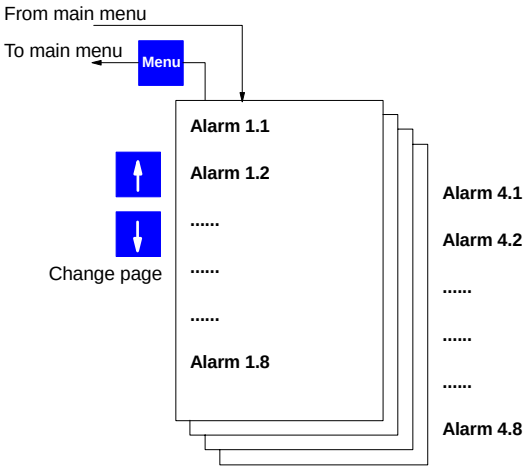


Figure 7: Alarm visualization.

8.2 Resetting alarms

At first the reset menu must be selected. Select the reset menu with the navigation buttons. Highlight the reset alarm line in the menu and then press ENTER **< <-' >**.

Some alarms might not be reset until the cause that generated it has not been removed. For example, an alarm due to an error in the tripping circuit (coil supervision) cannot be reset until the tripping coil has not been replaced. On the other hand, an alarm generated by a trip of a protection function is normally reset with this procedure.

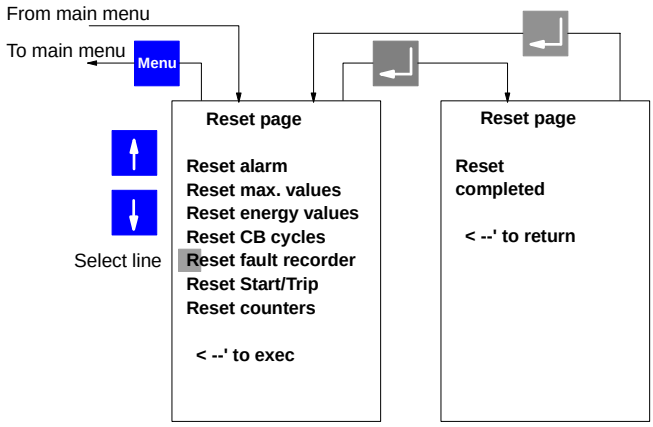


Figure 8: Resetting alarms.

9 Viewing measurements

The REF542*plus* offers a complete measurements set to the user. To view the measurements, select the measurement menu with the navigation button. Use UP <↑> and DOWN <↓> to browse the measurement pages.

The available measurements depend upon the unit configuration. In the maximum configuration, the following measurements are displayed:

- IL1, IL2, IL3, in A; line currents, measured values.
- U1E, U2E, U3E, in kV; phase to earth voltages, measured values.
- UL12, UL23, UL31, in kV; phase-to-phase voltages, computed values.[1]
- IL1 mean, IL2 mean, IL3 mean, in A; mean currents in the observation period, computed values.
- IL1 max, IL2 max, IL3 max, in A; maximum peak currents in the observation period, computed values.
- Frequency, in Hz; measured values.
- Active power, in kW; Reactive power in kVar, Apparent power in kVA, computed values.
- Power Factor, computed value.
- Real energy in MWh, Reactive energy in Mvarh; computed values.
- Operating hours, in hours. This is the total working hours of the unit.
- Switch cycle, number the circuit breaker close-open cycles.
- Added sw current, in kA; sum of the interrupted currents by the circuit breaker.

[1] REF542*plus* can also use phase-to-phase voltage transformers. When used, phase-to-phase voltages are measured and phase to earth voltages are computed.

- THD (total harmonic distortion).

Note

The observation period is set with the Operating Tool. It can be from 0 minutes up to 30 minutes. If the observation period is set to 0, the corresponding measurements are disabled.

The refresh time for the displayed measurements is about half second.

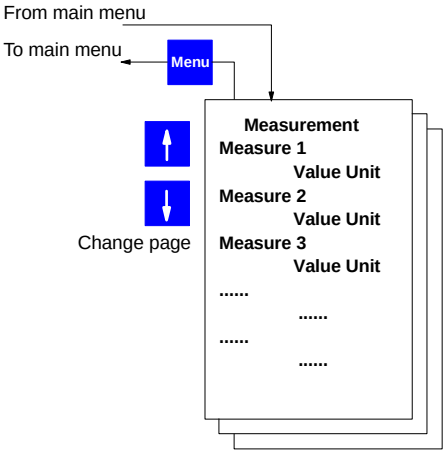


Figure 9: Measurements visualization.

Note

The available measurements depend upon the analogue input module type and the unit configuration.

10 Viewing events

The REF542*plus* records the last 30 protection events (start, trips, block and other). This internal memory is managed as a circular buffer; e.g. the 31st event overwrites the 1st oldest one. In case of power loss, events are kept because they are stored in non-volatile memory.

For each event, the following information is recorded: involved protection function, event type, relevant measurement (current, voltage, frequency), date and time (up to milliseconds). Events are displayed using the full screen; the single line diagram is thus not visible.

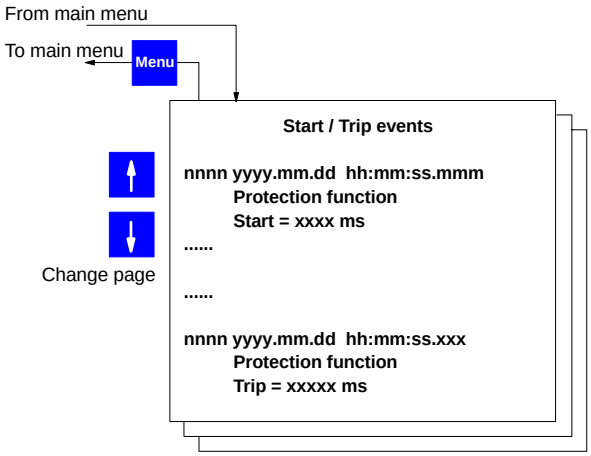


Figure 10: Events display.

To display the protection events, select the Start/Trip menu with the navigation buttons. Use UP <↑> and DOWN <↓> to browse through the events.

11 Viewing and changing the protection settings

11.1 Viewing the protection settings

The protection functions currently installed in the unit can be seen in the menu protection functions. Select the menu protection functions with the navigation push buttons.

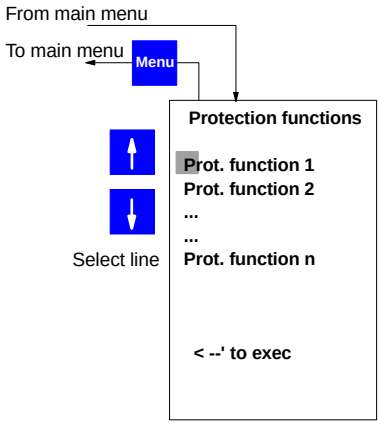


Figure 11: Viewing the installed protection functions.

Use UP <↑> and DOWN <↓> to highlight the desired protection function and then press ENTER **< <-' >**. Then, the protection parameters will be displayed in one or more pages.

11.2 Changing the protection settings

11.2.1 Changing the protection key mode

Two different modes are available for the protection functions:

Set

It is possible both to visualize and to change the protection settings.

Operational

It is possible to visualize the protection settings but it is not possible to modify them.

In both modes, the protection functions are active.

In the operational mode, parameterization of the protection functions is also possible by a Scada, when present. In the set mode, parameterization from a Scada is inhibited.

The procedure to change the protection mode is identical to change the control mode. At first the menu E-Key must be selected. Then the protection key must be placed in the electronic key sensor. Select then the required protection mode using UP <↑> and DOWN <↓> until it is highlighted. Confirm the selection pressing ENTER **< <-' >.** After having pressed ENTER **< <-' >** push button, the E-key status menu will appear again. Verify that the required protection mode has been properly set in the unit, looking in the HMI lower left corner.

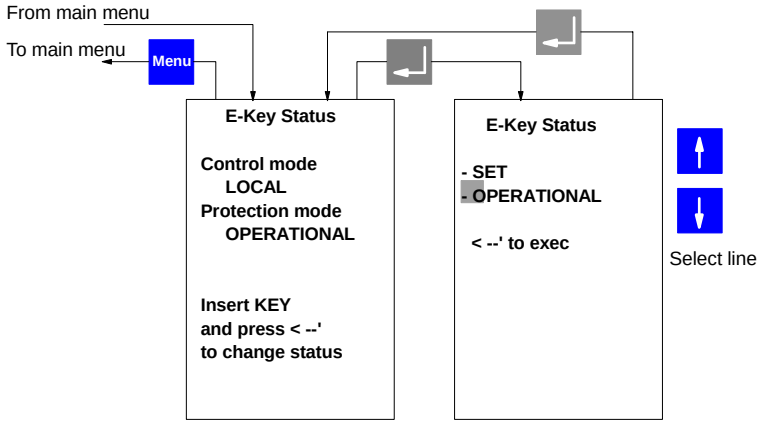


Figure 12: Changing the protection mode using the protection key.

11.2.2 Changing the protection parameters

Select the menu protection functions with the navigation push buttons and highlight the desired protection function. Press ENTER **< <-' >** to select it. Press again ENTER **< <-' >** and the cursor will automatically go to the first parameter. Use Up <↑> or Down <↓> to modify the parameter as wished. After completed, press ENTER **< <-' >** and use Up<↑> Down <↓> to select the next parameter to change.

Repeat the procedure for all the parameters that need to be modified. Then press < **Menu** > to go back to the list of currently installed protection functions. Repeat the procedure for every protection function that needs to have the setting modified.

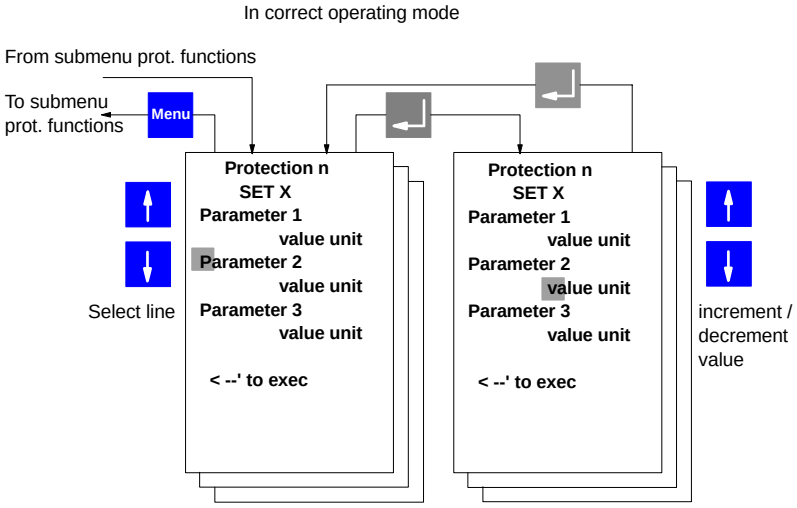


Figure 13: Changing protection parameters.

Press again < **Menu** > to leave the protection functions menu. The unit will then ask what to do with the changes:

The following screen will appear:

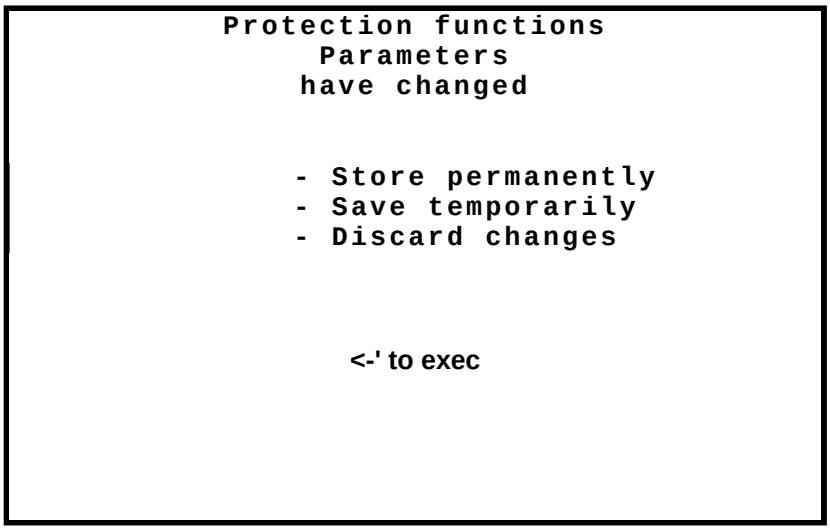


Figure 14: Unit right screen after protection parameters modification.

Select the desired choice with Up<↑> or Down <↓> and then press ENTER **< <-' >** to confirm it. The meaning of the choices is as follows:

Store permanently

The new parameters are stored in the unit internal memory. They will be used immediately and for all the next starts.

Save temporarily

The new parameters are used immediately but are not saved in the unit internal memory. Next starts will use the old parameters.

Discard changes

The new parameters are discarded. There are no effects.

Warning!

Do not switch off Base Unit power supply during parameters storing. The whole unit configuration might be corrupted and a new configuration download migth be necessary.

11.2.3 Changing the active parameter set

Most of the protection functions have two different parameter sets, to cope with different plant situations. This menu allows seeing and changing the active parameter set.

Changing the active parameter set is possible only with the protection in the set mode.

Select the active set page menu and press ENTER **< <-' >** to make the change.

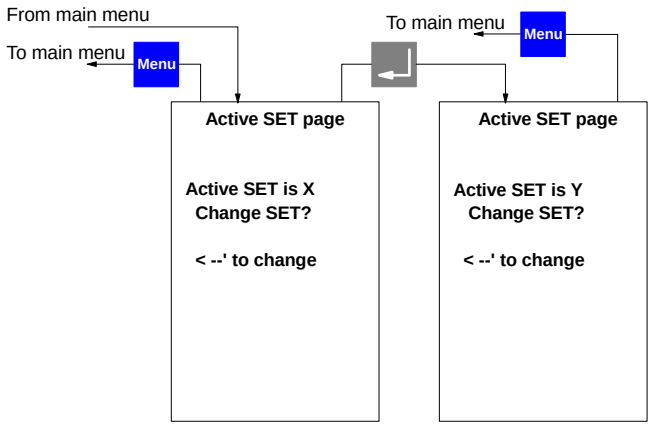


Figure 15: Changing the protection active parameter set.

11.2.4 Viewing and changing Control parameterss

Select the menu Control with the navigation push buttons and highlight the desired control function. Press ENTER **< <-' >** to select it. Press again ENTER **< <-' >** and the cursor will automatically go to the first control parameter. Use Up <↑> or Down <↓> to modify the parameter as wished. After the modification, press ENTER **< <-' >** and use Up<↑> Down <↓> to select the next parameter to change.

Repeat the procedure for all the parameters that need to be modified. Then press < **Menu** > to go back to the list of currently installed protection functions. Repeat the procedure for every protection function that needs to have the setting modified.

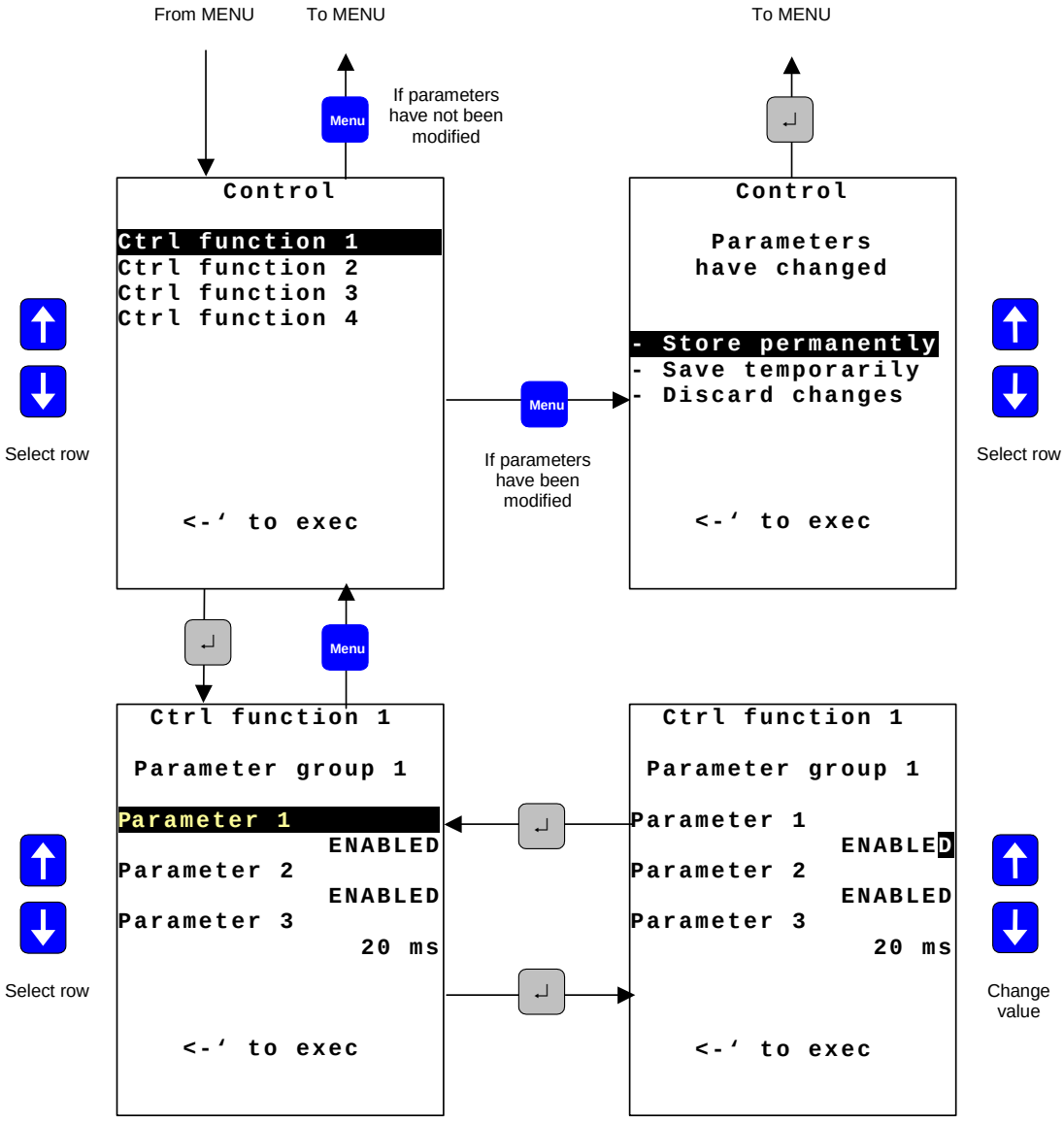


Figure 16: control parameters page.

12 Setting the time and date

During commissioning, the internal time and date of the unit should be set to the current values. There are a few differences according to the unit configuration.

Stand-alone unit

The internal time of the unit has to be set to the current value. To do that, select the service menu, and then the MC time sub menu with the navigation buttons.

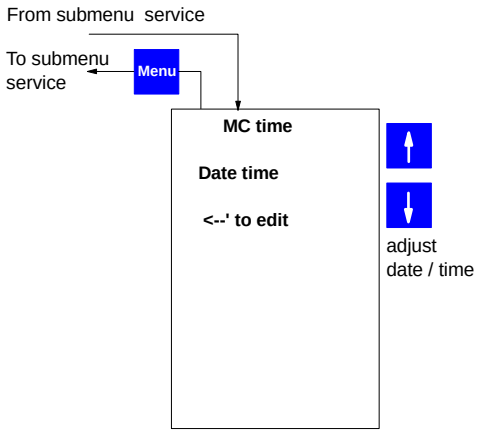


Figure 17: Setting the time.

The time is edited using UP < ↑ >, DOWN < ↓ > and then ENTER **< <-' >** to confirm. The complete date and time must be inserted: year, month, day, hour, minutes, seconds.

Unit connected to a master clock

When the unit is connected to a master clock (typically a clock which receives its signal from a GPS), only the year can be set. The remaining part of the date and time is received from the master clock.

Unit connected to a Scada system

Usually, the Scada transmits to the unit the date and time according to the used protocol services. There are some differences depending upon the used protocol.

IEC 103 protocol: The IEC 103 module is the time master. Setting the time and date from the HMI is inhibited.

LON Lag 1.4 protocol. The LON module is the time master. Setting the time and date from the HMI is inhibited.

SPABus and MODBUS protocols: usually, the Scada sets the date and time, nevertheless setting the time and date from the HMI is allowed.

13 Command page

From this page it is possible to access to the HMI command objects configured in the application software of the REF542*plus*. More details on these objects can be found in the Operating Tool user manual.

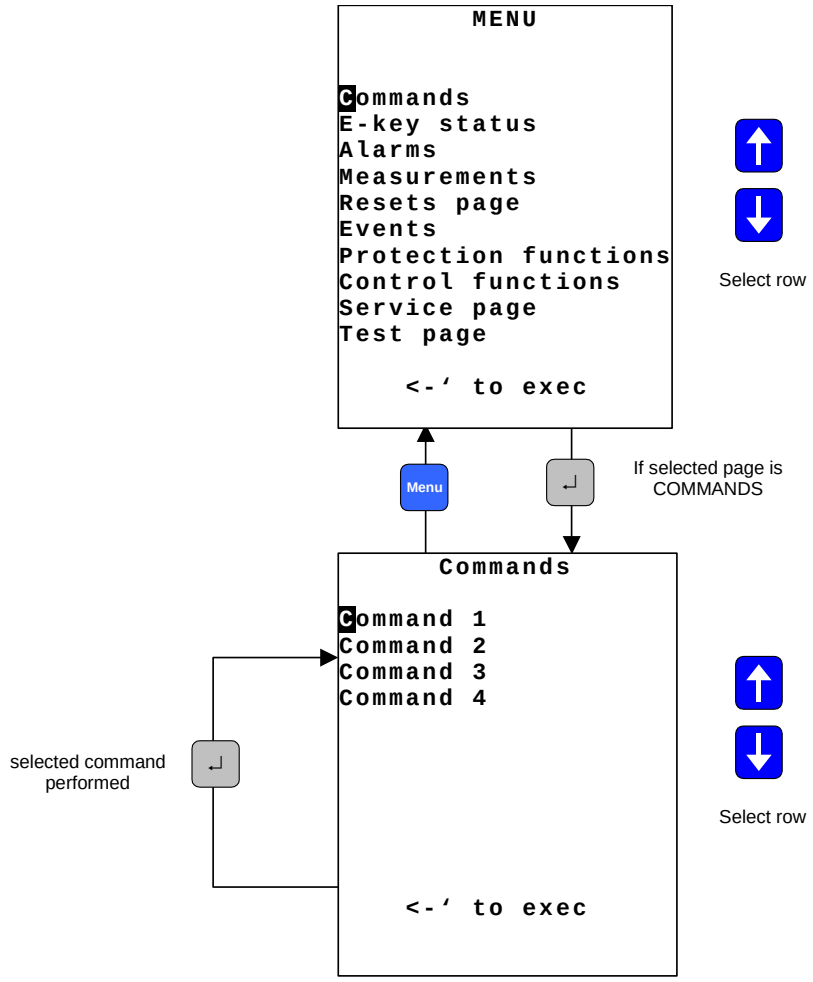


Figure 18: Command page.

Selecting the desired command and pressing ENTER **< <-' >** the command is executed.

14 REF542*plus* commissioning mode

The commissioning test mode allows accessing all the digital and analogue inputs and outputs of the REF542*plus*. This mode is independent of the REF542*plus* application. This working mode has been designed to make easier the wiring verification.

The super user key is required to enter this mode.

Warning!

Entering this mode STOPS the execution of the protection and control functions. The application software is not running. However it is not deleted from the permanent memory of the unit. The commissioning test mode should be entered when the switchgear is de-energized and in a safe state.

To switch on this mode the following actions have to be performed in sequence.

1. Switch off the REF542*plus* Base Unit.
2. Place the super user key on the e-key sensor and keep it contacted.
3. Switch on the Base Unit.

When the Base Unit starts the e-key is detected. The Commissioning mode is entered. Verify this by reading on the startup status line "COMMISSIONING MODE". When this text is visible, the e-key can be unplugged from the e-key sensor.

Warning!

This mode allows driving directly the binary outputs of the Base Unit: if they are connected to primary objects, operations are thus possible. The interlocking functions are disabled. Before accessing this mode put the switchgear in safe conditions.

When entering the commissioning mode the following screen is displayed.

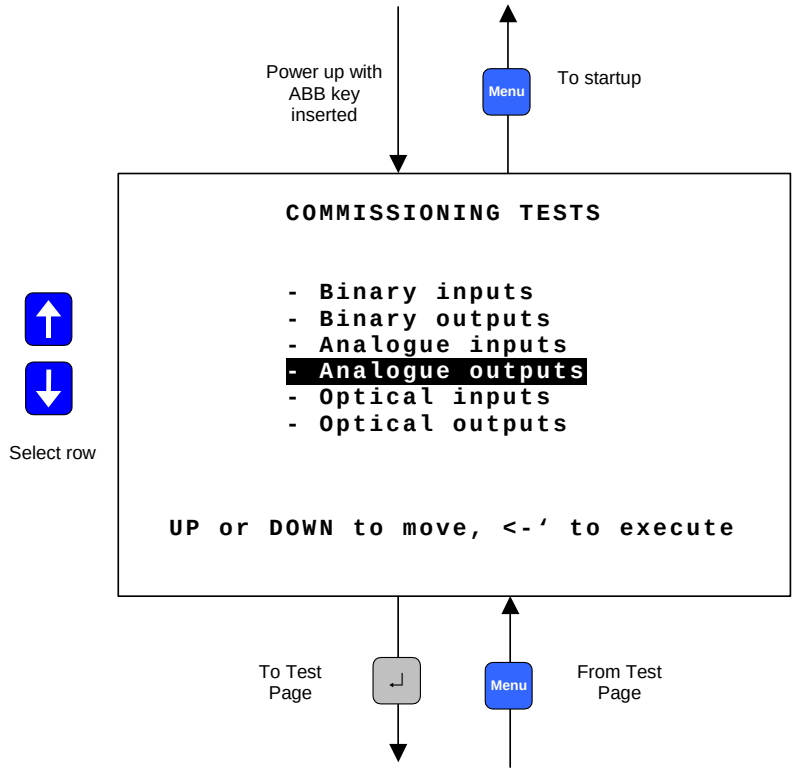


Figure 19: Commissioning mode display

Binary input commissioning page

This page displays the current status of the binary input channels on the binary IO modules. 14 binary inputs per module are available. For the binary inputs numbering see 17.2.

Line description: *"Channel descriptor" "Channel number ": "Values"*

Channel descriptor:	Binary input
Channel number:	x-yy. Where x addresses the binary IO slot, yy is the binary input number. 1 means X20 slot and so forth.
Values:	0 → input is not active. Applied voltage is below the activation threshold.
	1→ input is active. Applied voltage is above the activation threshold.

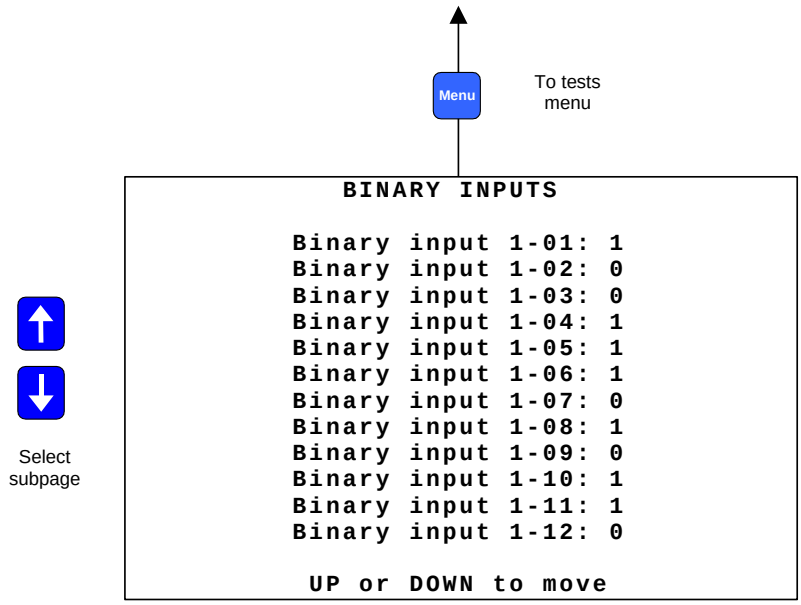


Figure 20: Binary inputs commissioning page

Binary output commissioning page

In this page it is possible to force the status of the binary outputs. All the outputs can be driven with the exception of the watchdog.

Line description: *"Channel descriptor" "Channel number ": "Values"*

Channel descriptor:	Binary output
Channel number:	x-yy. Where x addresss the binary IO slot, yy is the binary output number. 1 identifies the X21 connector and so forth.
Values:	0 → output is opened. The relay is not energized.
	1→ output is closed. The relay is energized. Normally opened contacts are closed.

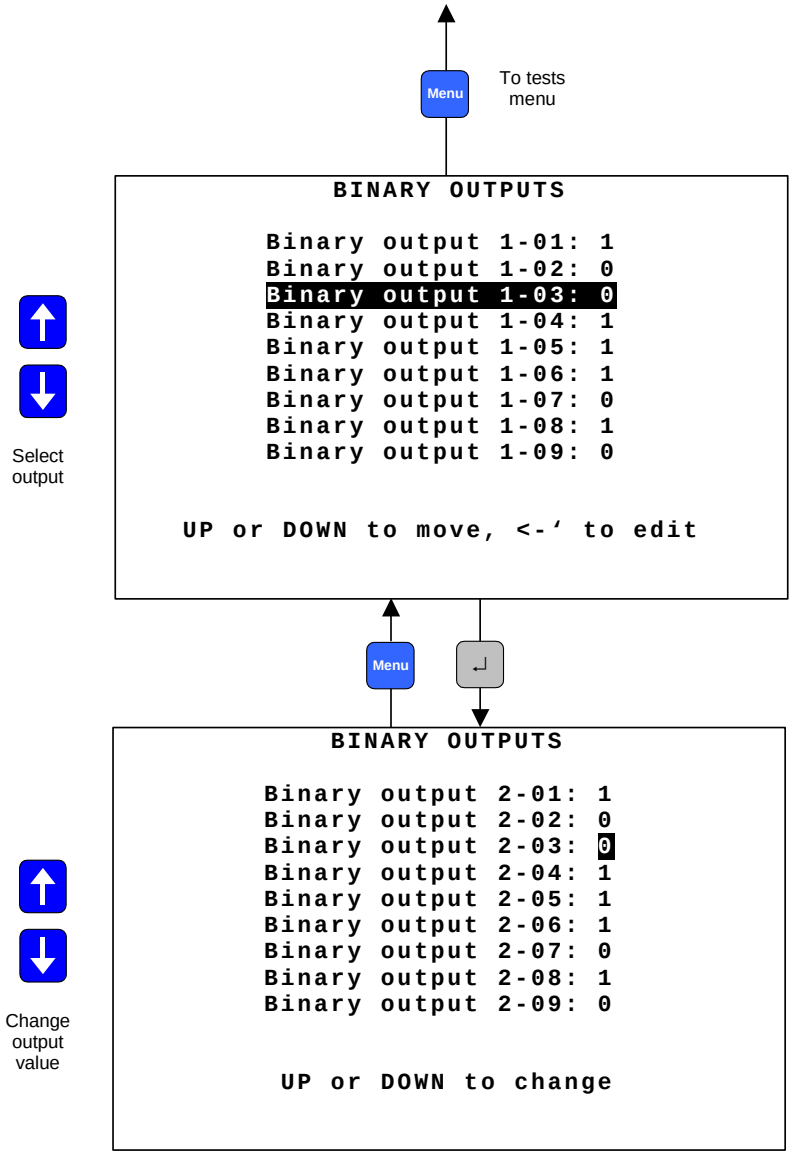


Figure 21: Binary outputs commissioning page

Analogue input commissioning page

This page shows the analogue measurements acquired by the analogue input module. The shown values are independent on the rated primary current or voltage of the primary sensors. The measurements are reported in absolute values taking into consideration as nominal values of the secondary windings 1 Amp and 100 V. If the 5 Amp current inputs are connected, applying the nominal rated current it will be shown 1 A.

Line description: *"Channel descriptor" "Channel number ": "Values"*

Channel descriptor:	Analogue input
Channel number:	x, where x addresses the analogue input channel.
Values:	- CT (1-5A) → Rated secondary current related to 1 Amp current input.
	- CT (0,2 A) → Rated secondary current (Amp).
	- VT (100 V) → Rated secondary voltage (Volt).
	- Sensor → Voltage output of the sensor (Volt).

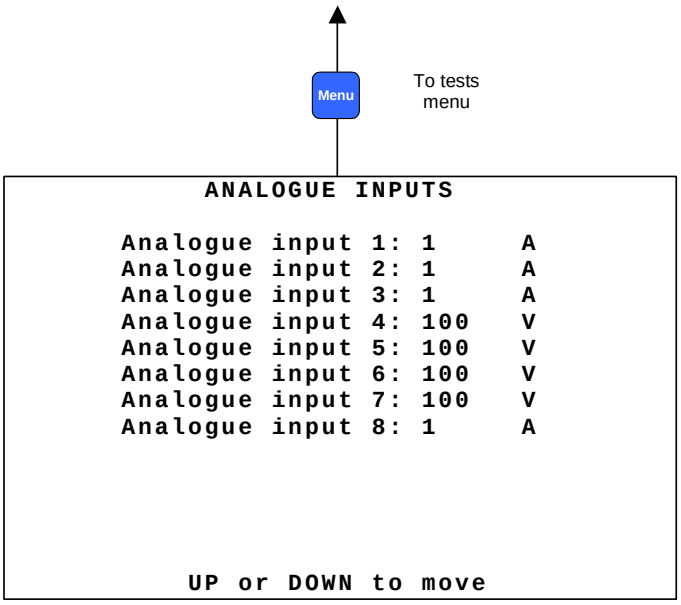


Figure 22: analogue inputs commissioning page for the 3CT, 3VT, 1VT, 1CT module

With sensor inputs, the displayed values are the voltages read by the analogue channels. E.g. using the voltage divider 10.000/1 applying 20 kV on the sensor, the measurement will show 2 Volt. For the current sensor 80 A/150 mV, applying 80 Amp on the sensor the measure will be 0.150 Volt.

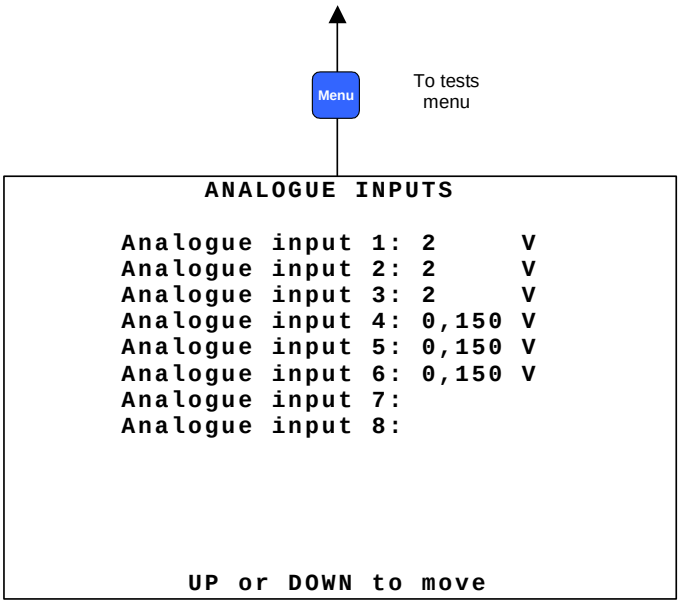


Figure 23: analogue inputs commissioning page for the 6 sensor module, connected to 3 voltage divider and 3 Rogowski coils

Analogue output 4- 20 mA commissioning page

This page allows setting the value of the analogue channels in the 4-20mA module.

Line description: *"Channel descriptor" "Channel number ": "Values"*

Channel descriptor:	Analogue Output
Channel number:	x. Where x addresses the analogue output channel.
Values:	0 - 20 mA, step 1 mA. The value can be set with UP < ↑ >, DOWN < ↓ >.

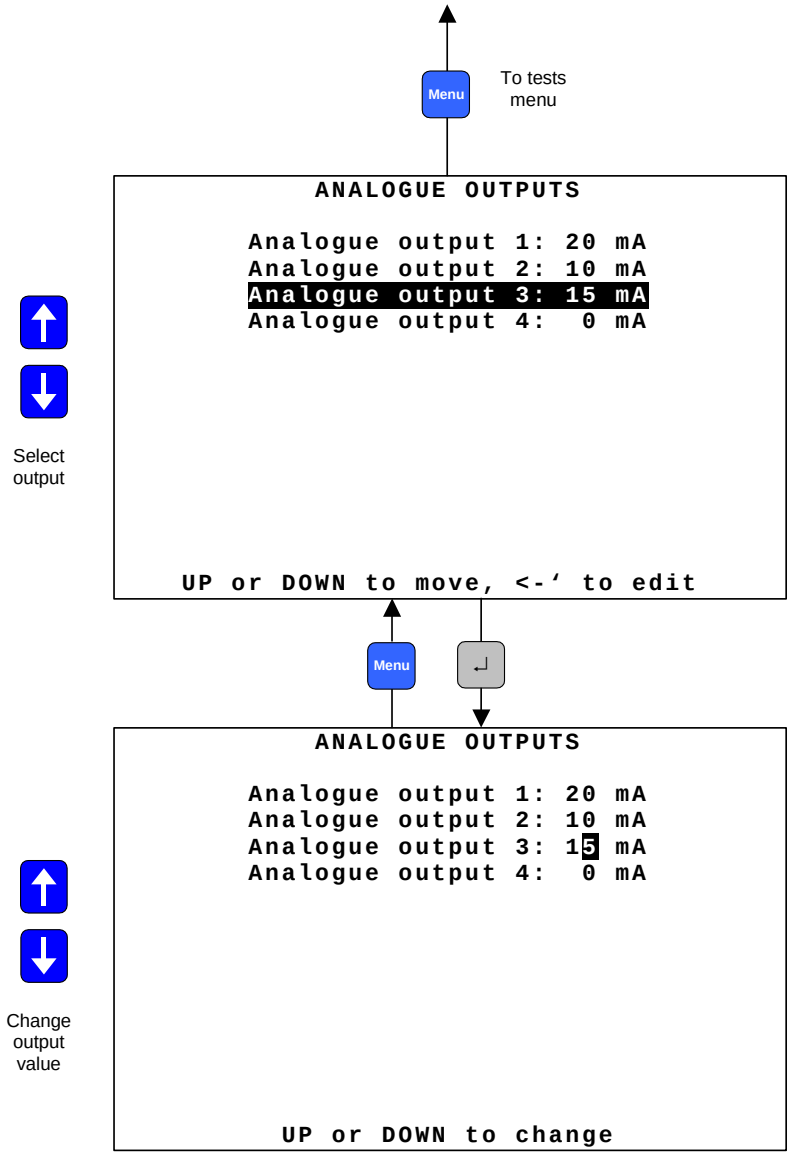


Figure 24: a4-20mA analogue outputs commissioning page

Analogue input 4-20 mA commissioning page

From this page it is possible to read the analogue measurements of the Analogue Input 4-20 mA module. The shown measurements will be depending on the connected sensor type. In case of a general 4-20 mA sensor, the value of the applied current to the channel is displayed. In case of a SF6 Trafag sensor, the density and the temperature are displayed.

Line description: *"Channel descriptor" "Channel number ": "Values"*

Channel descriptor:	General 4-20mA sensor → General sensor Trafag → Density, Temperature
Channel number:	x. Where x addresses the analogue input channel.
Values:	General Sensor → 4-20 mA, for Trafag the density and the temperature.

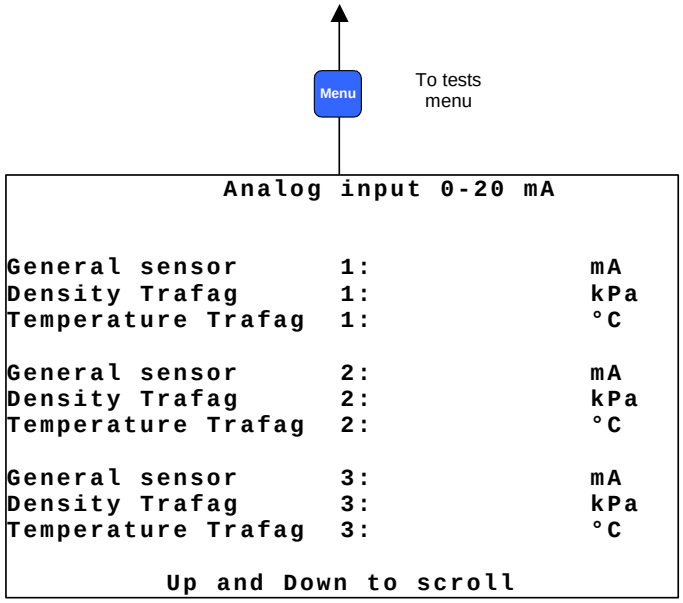


Figure 25: 4-20mA analogue inputs commissioning page

Optical inputs commissioning page

This page displays the status of the optical inputs on the main module. This mode is available only with main modules equipped with the optical inputs (1VCF751021R0803, X74 only and 1VCF751021R0801 for all).

Line description: *"Channel descriptor" "Channel number ": "Values"*

Channel descriptor:	Optical Input
Channel number:	x. Where x addresses the optical Input channel.
	1: X74 (time synch input)
	2: X75
	3: X76
Values:	0: Optical input is off (no light is present).
	1: Optical input is on (light is present).

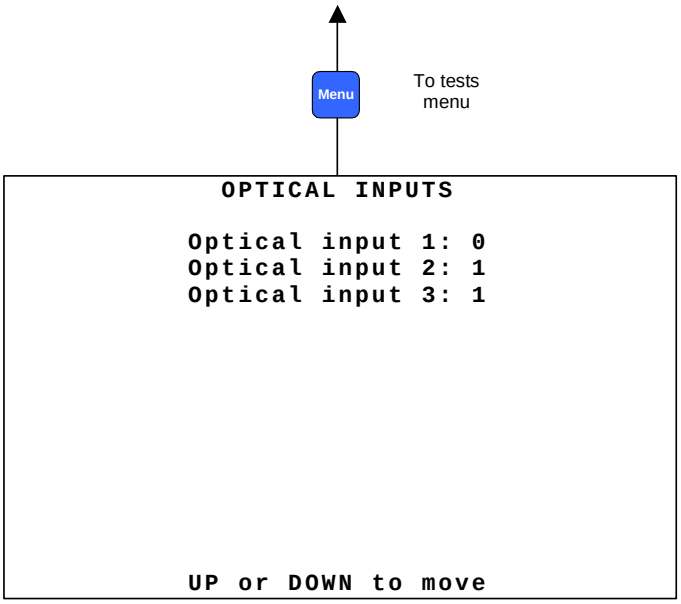


Figure 26: Optical inputs commissioning page

Optical Output commissioning page

This page allows driving the optical output on the main module (only type 1VCF751021R801).

Line description: *"Channel descriptor" "Channel number ": "Values"*

Channel descriptor:	Optical Output
Channel number:	x. Where x addresses the optical output channel.
Values:	0: Optical output is off (light not present).
	1: Optical output is on (light present).
	The value can be selected with UP < ↑ >, DOWN < ↓ >.

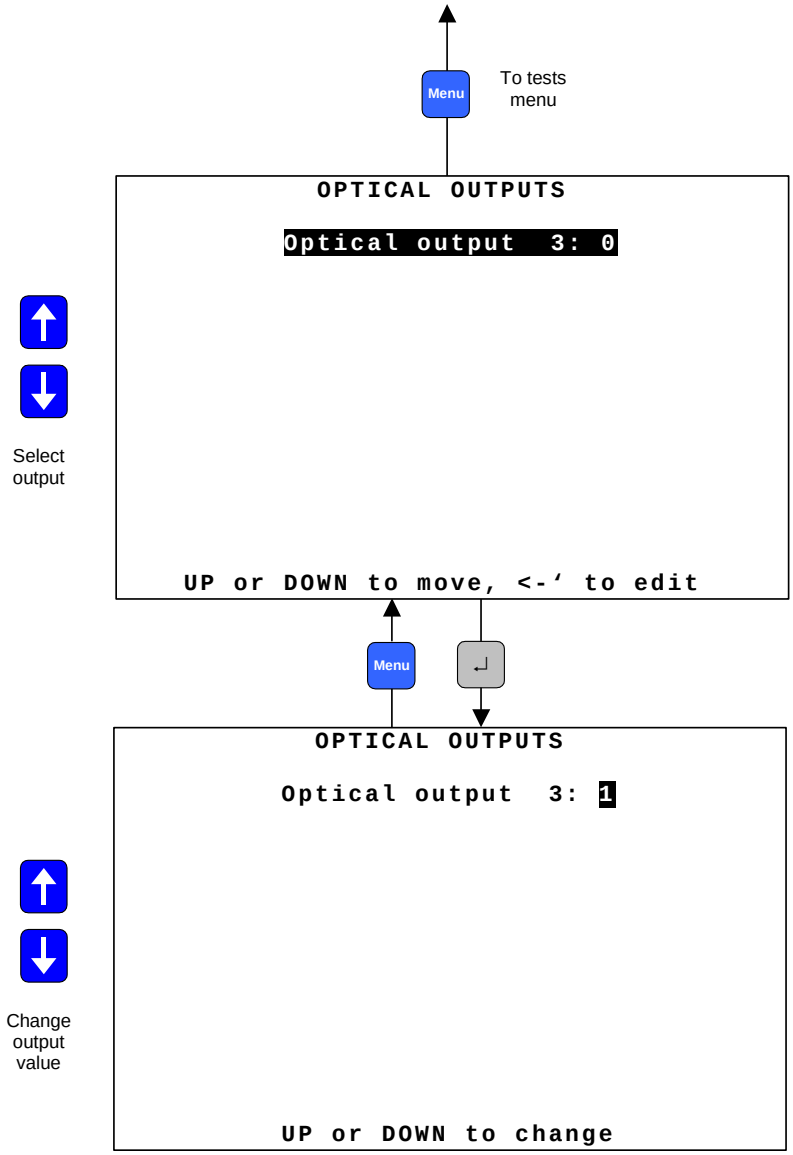


Figure 27: Optical output commissioning page

15 Connection to a PC

15.1 Optical to RS232 converter cable

A special cable with an optical interface is needed to connect the REF542*plus* to a serial port of a PC. This cable is available from ABB.

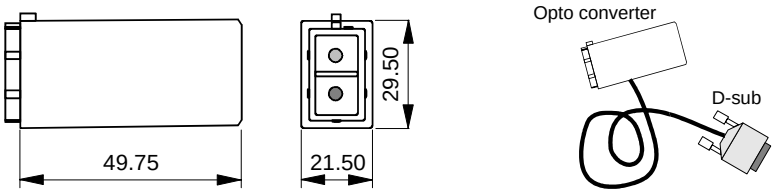


Figure 28: REF542*plus* serial cable.

15.2 Downloading a configuration

With the Operating Tool, and after having set up the connection with the appropriate cable, it is possible to download the configuration into the REF542*plus*. Connect the optical converter into the optical PC connector on the HMI and the D-sub connector into the PC. Start the Operating Tool on the PC and select the serial port to be used inside the program.

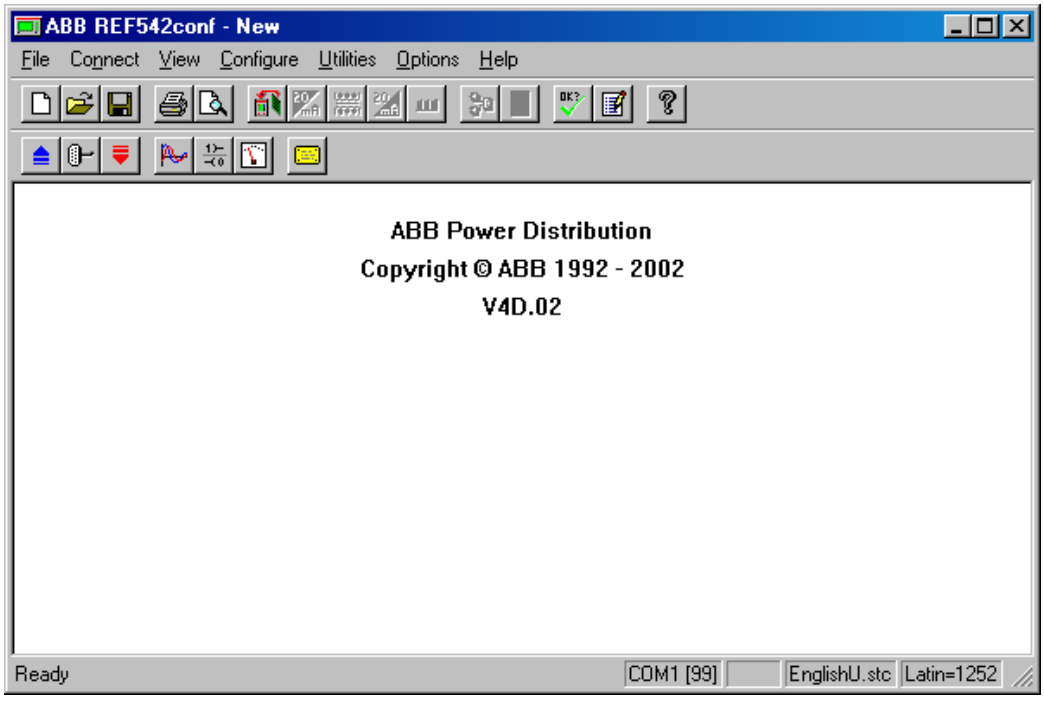


Figure 29: Operating Tool: Transfer menu.

15.2.1 Serial port Settings

Figure 30: Operating Tool: setting the communication parameter of the serial port.

Select the COM port where the RS232/optical cable is plugged in.

Apply the following settings:

Baud rate	19200
Data bits	8
Stop bit	1
Parity	Even

Base Unit slave address: This number can be from 1 to 254. When several Base Units are connected to the same HMI, this number uniquely identifies the Base Unit. The default address is 99.

To configure or to change the Base Unit slave address there are two methods:

- Open the application file with the Operating Tool and change it in the Hardware settings.

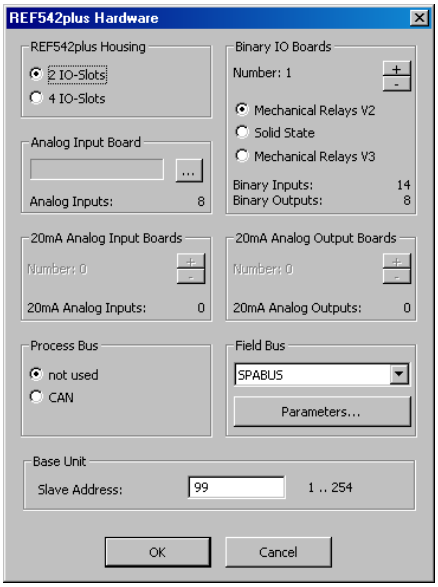


Figure 31: Operating Tool: Changing the Base Unit address.

or:

- Via the HMI menu → Service page → Communication → HMI PORT

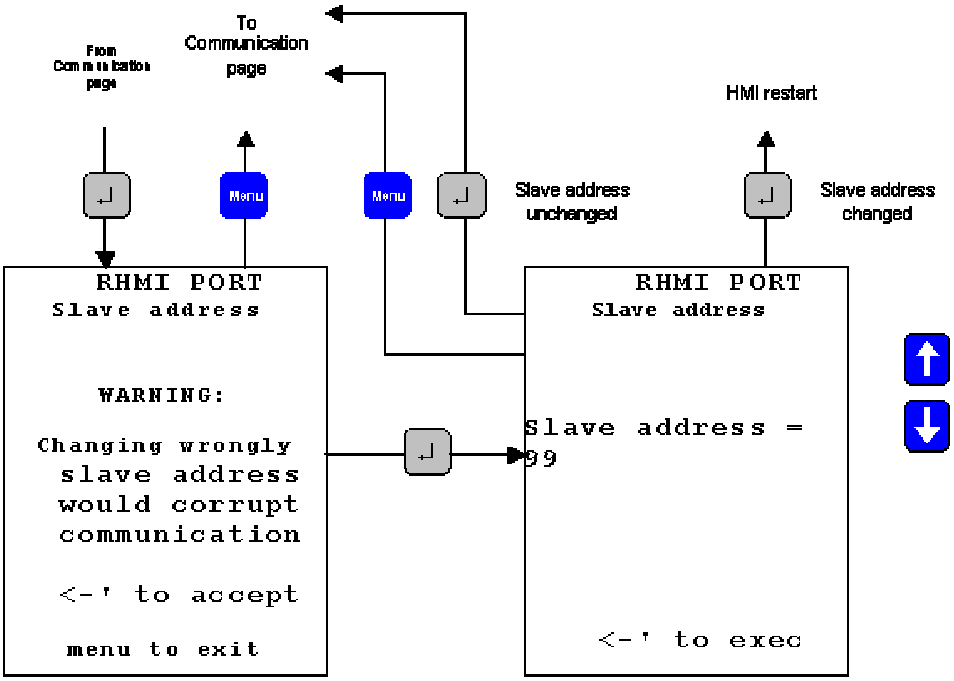


Figure 32: Changing the Base Unit address from the HMI.

Please note:

When the ALARM led is on, the download is inhibited.

The configuration download starts as soon as the relevant push button on the Operating Tool is clicked.

The previous configuration inside the REF542*plus* is destroyed, overwritten by the new one.

The REF542*plus* is fully operational during the download. After the download, the REF542*plus* starts to write the new configuration in the non-volatile with a low priority task in background. This task migth take several seconds.

Warning!

Do not switch off Base Unit power supply during the storing. The whole unit configuration might be corrupted and a new configuration download might be necessary.

The download is possible in all the control modes, but the no control.

Communication to the SCADA system is operational during the download.

After the download, the REF542*plus* automatically starts with the new configuration.

Warning!

After the download is completed the unit may change the operational status of the output relays due to the new logic configured in the application file. It is strongly recommended to put the switchgear in safe conditions before performing the download.

15.3 Uploading the configuration

With the Operating Tool, it is possible to upload the current configuration inside the REF542*plus*. Set the Operating Tool and the PC like for the download and click on the menu Transfer/load from REF542*plus*.

Please note:

The configuration being uploaded overwrites the current one inside the Operating Tool.

The upload is possible in all control modes and does not affect the functioning of the unit.

15.4 Uploading other information

With the Operating Tool, other information can be uploaded from the REF542*plus*. Different data can be uploaded:

- The fault recorder file
- The binary input status
- The binary output status
- The measurements
- The software version

All this data are accessible with the Operating Tool from the Transfer menu. Refer to the Operating Tool manual for more details.

16 Troubleshooting

16.1 Error messages

◆ Base Unit not responding or Communication corrupted or Wrong slave address.

When the HMI is not able to communicate with the Base Unit, the following appears on the LCD:

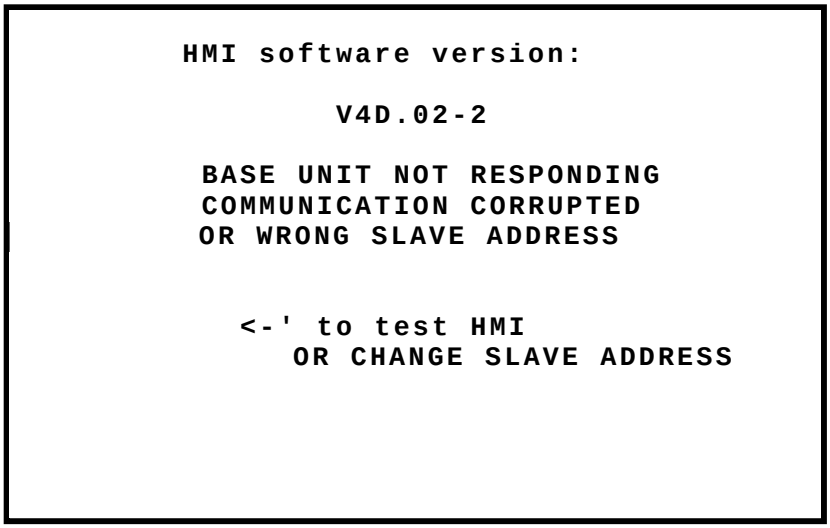


Figure 33: HMI is not able to communicate with the Base Unit.

Solution:

Check that the Base Unit is powered and regularly working. Look at the status Leds on the connector panel (Slot X7).

The Led close to the analogue inputs is related to the watchdog. When the Base Units is working this LED is on with a weak light.

The Other Led is related the communication with the HMI. When the communication is properly working, this led is blinking. When the communication is not working, the Led can be either ON or either OFF (it depends when the communication is interrupted).

Check that the connection cable between the HMI and the Base Unit is inserted both in the HMI and in the Base Unit (Base Unit connector X12D) and properly tighten.

Check the slave address of the connected Base Unit to be polled. The address is configured in the application file. If you don't know you can enter the following page by pressing the enter key.

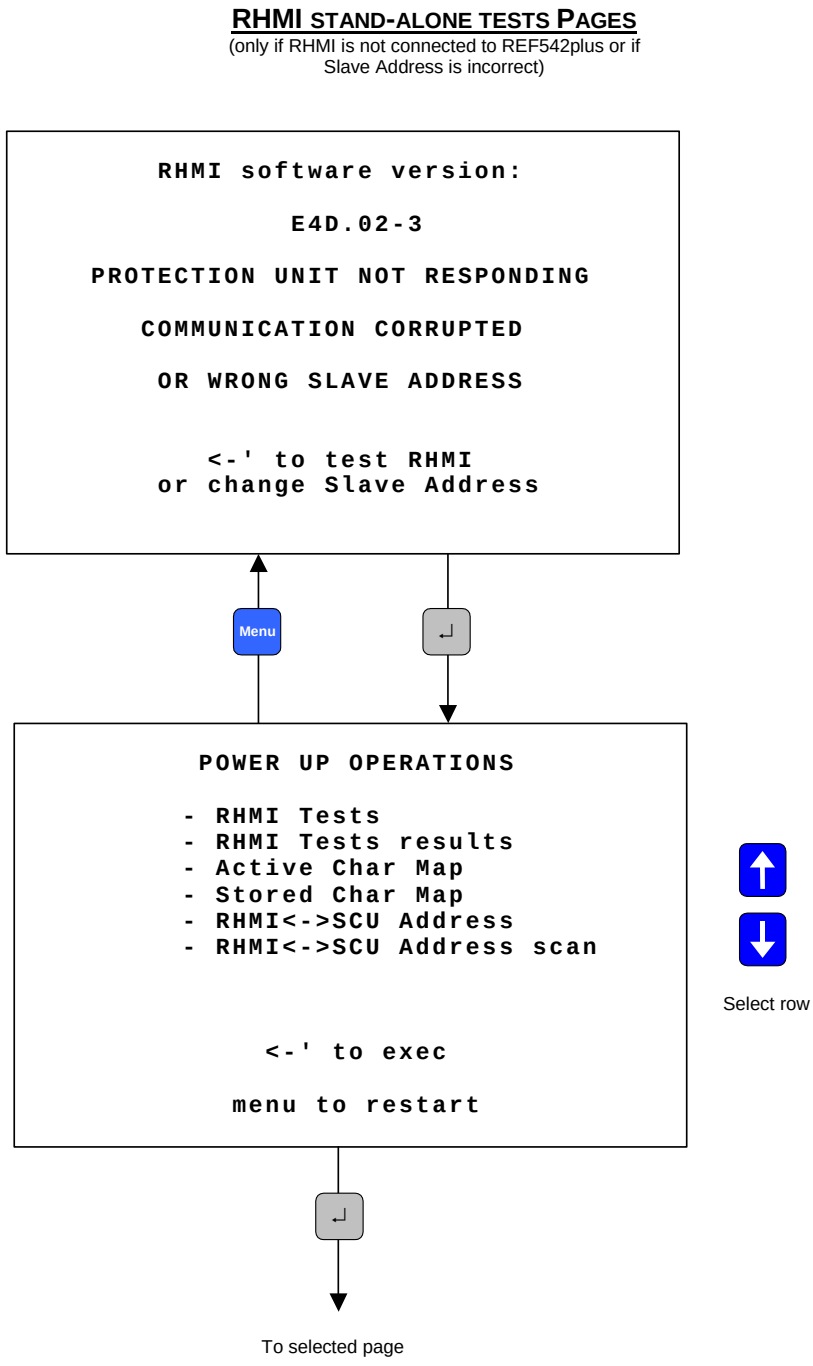


Figure 34: HMI test page

Select "HMI <-> Base Unit address scanning" menu item and press Enter.

The HMI will start polling all the addresses to find the connected Base Units. When a unit is found, its address and the feeder name are reported.

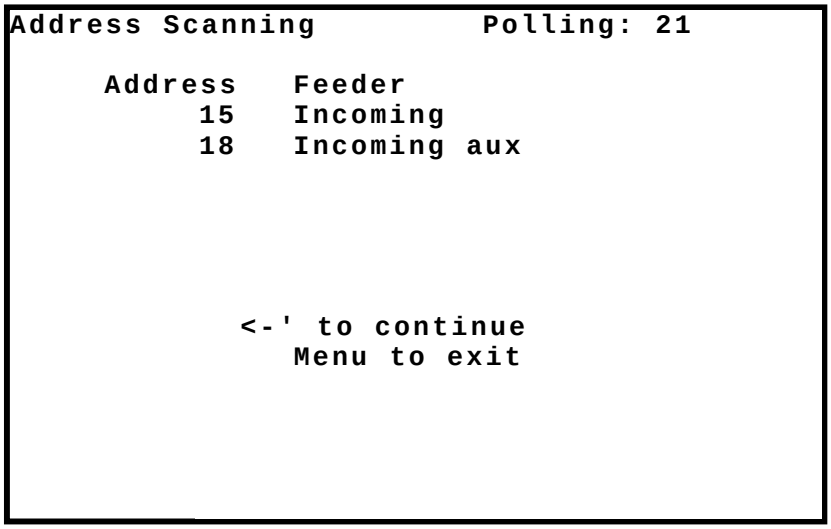


Figure 35: HMI is polling the Base unit addresses.

Select then the "HMI <-> Base Unit address" to change the address o be polled.

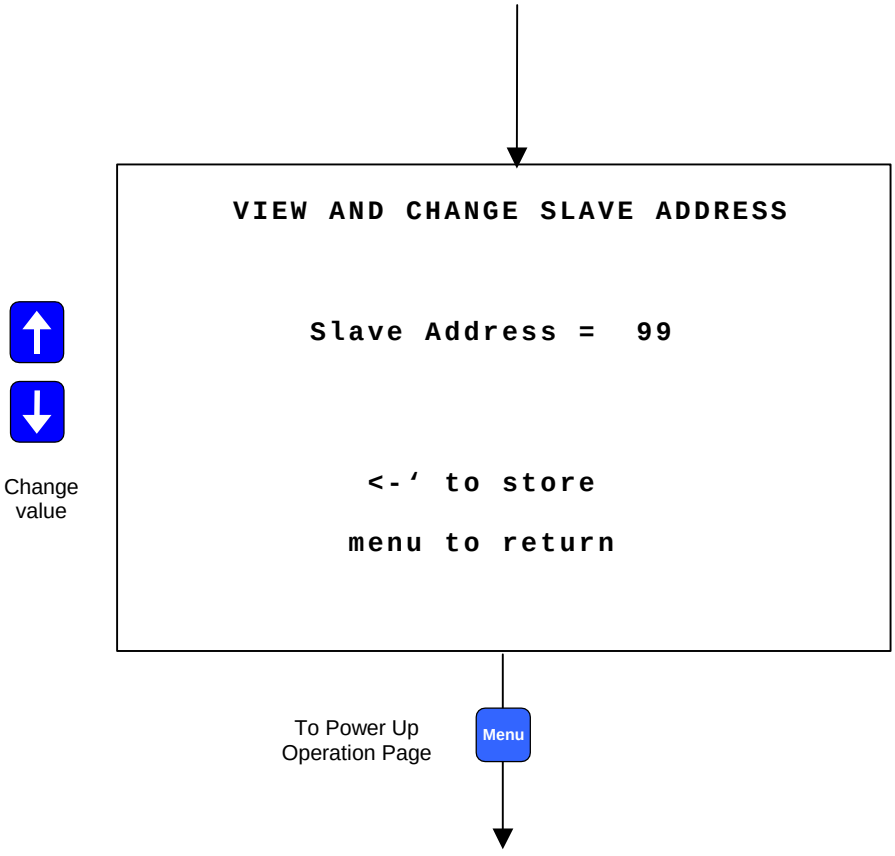


Figure 36: Changing the Base Unit address to be polled.

- HMI Self Test

Press ENTER **< <-' >** to start the test for the HMI.

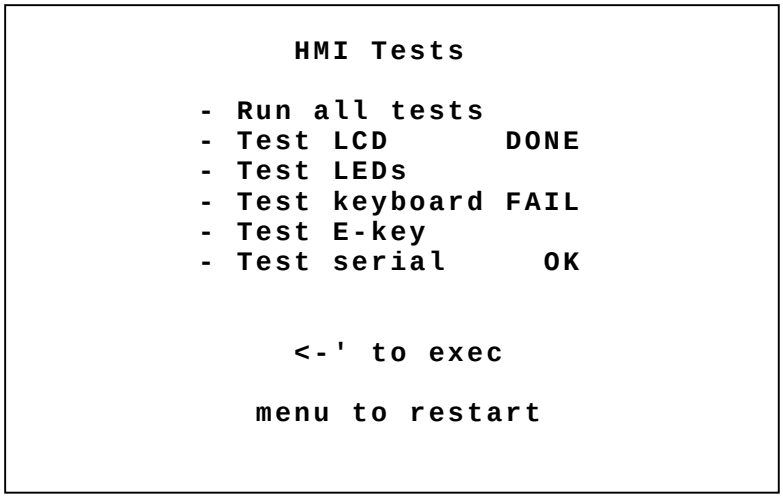


Figure 37: HMI test page.

The REF542*plus* is without configuration when the following message appears:

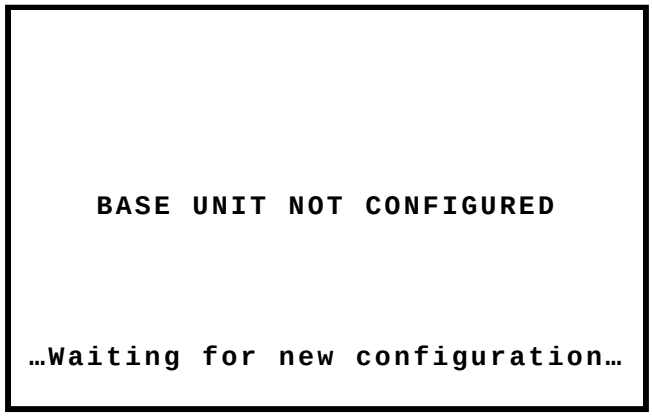


Figure 38: REF542*plus* without configuration.

Solution:

Download the configuration into the unit using the serial cable and the Operating Tool.

- Configuration not loaded

The following message appears when the downloaded configuration has not been saved inside the unit due to an internal error.

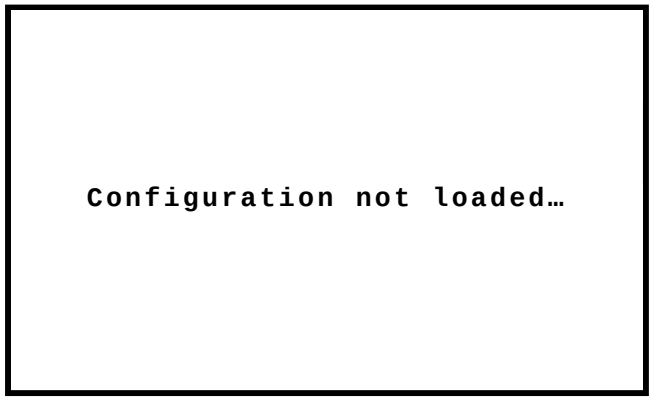


Figure 39: REF542*plus* configuration is not stored in the unit internal memory.

Solution:

Try to download again the configuration. If after two or three attempts the error remains, contact ABB.

Wrong Configuration

The following message appears when a not correct configuration has been downloaded in the Base Unit. This message can also appear when the configuration contains protection functions that exceed the unit functionality level.

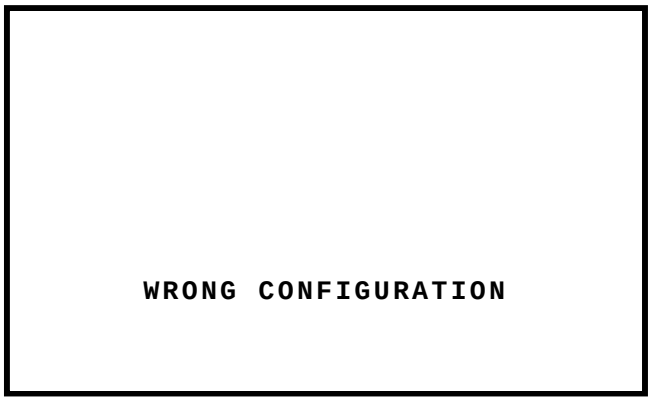


Figure 40: REF542*plus* with wrong configuration.

Note

For any other error message, contact ABB.

16.2 Clearing the configuration inside the unit

In some cases, there might be the need to delete the configuration stored inside the REF542*plus*. For example, when the RED alarm is on it is not possible to download a new configuration inside the REF542*plus*. The following procedure deletes the configuration inside the REF542*plus*:

- Switch off the Base Unit power supply (disconnect the X10 connector from the Base Unit).
- Press simultaneously the up  and down  buttons on the HMI and keep them pressed.
- Switch on the Base Unit Again.

After this procedure, the REF542*plus* is without configuration. Download a new configuration in the unit.

Note

This procedure deletes the configuration stored inside the REF542*plus*.The configuration cannot be recovered. Upload the configuration and save it before deleting it from the unit.

16.3 Primary objects incorrect visualization

The primary object status is usually acquired by the REF542*plus* with 2 distinct contacts, one that is closed when the object is closed, and another one that is opened when the object is opened.

The primary object is visualized in open position with a dotted line when both contacts are opened (the REF542*plus* has no voltage at both contact inputs).

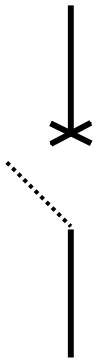


Figure 41: REF542*plus* has no voltage at both inputs indicating the primary object position.

The primary object is visualized in both in open and close positions when both contacts are closed (the REF542*plus* has voltage at both its contact inputs).

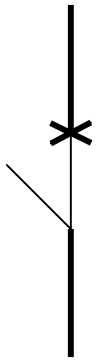


Figure 42: REF542*plus* has voltage at both inputs indicating the primary object position.

Solution:

Check the wiring of the primary object. Verify that the REF542*plus* connectors are properly inserted and tighten. Note that also with the primary object in such undefined positions, issuing an open command will activate the open coil on the circuit breaker. The open operation is never blocked. The close operation with the object in the undefined position is blocked. A close command will be discarded and will turn the interlocking error led on.

17 Appendix A: Connection diagrams

The pictures below show the connections plate for REF542*plus* both in the wide and standard housing versions. The wide housing version can house three binary input and output modules, the communication module and, the analogue output module or alternatively the analogue 4-20mA input module. The standard housing version can house at most two binary input and output modules and alternatively the communication or the analogue output module.

The connectors meaning is explained in the following.

Warning!

Do not operate a switchgear unless the REF52*plus* connections are properly done, verified by an expert electrician and tighten.

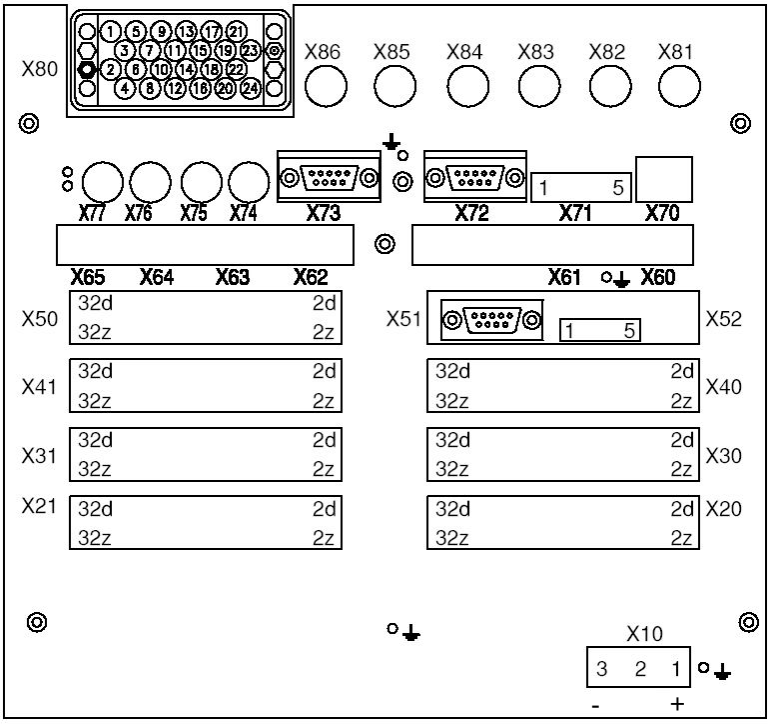


Figure 43: REF542*plus* wide housing connections plate with mixed analogue input connector.

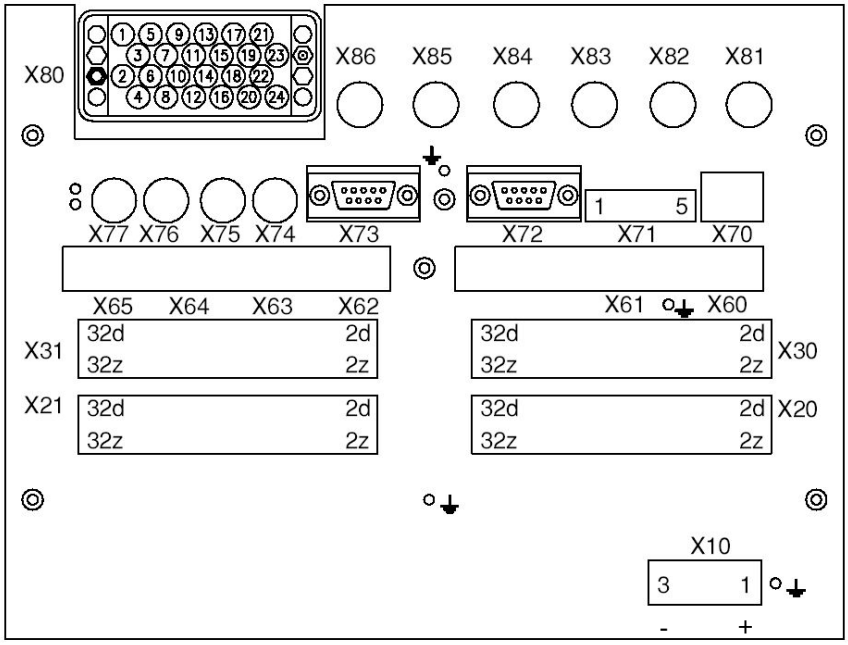
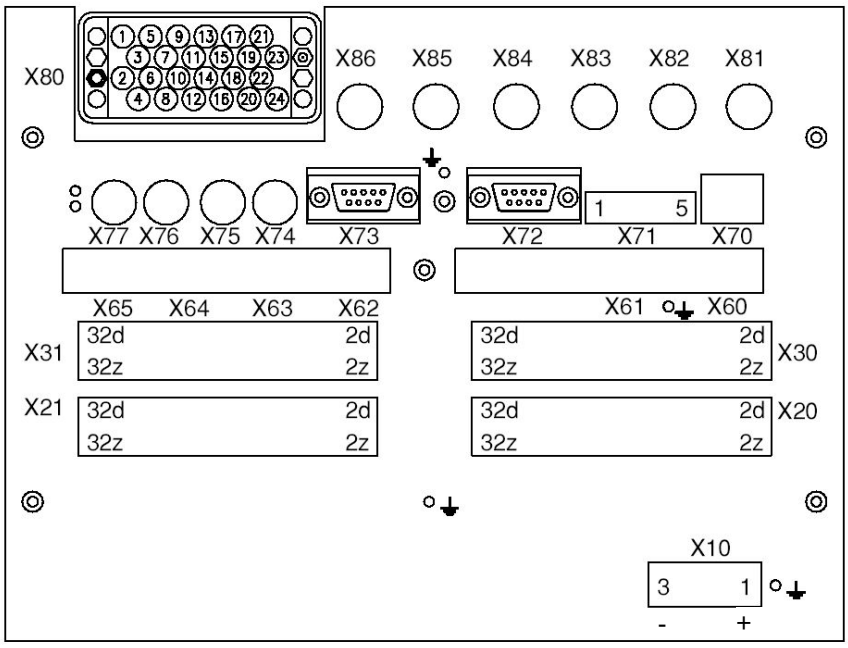
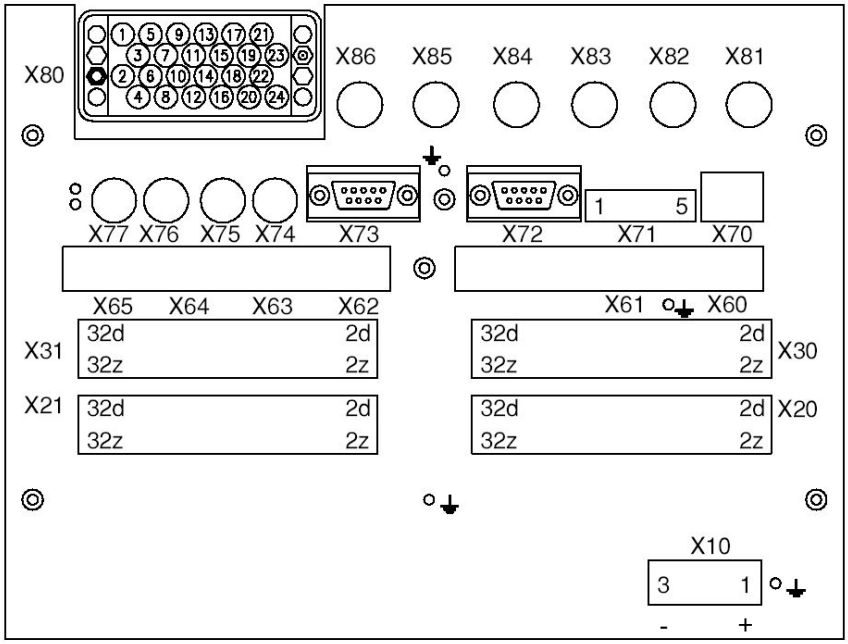


Figure 44: REF542*plus* standard housing connections plate with mixed analogue input connector.





The table below summarizes the connectors

Connector	Meaning
X10	Base Unit power supply
X20	First BIO, input
X21	First BIO, output
X30	Second BIO, input
X31	Second BIO, output
X40	Third BIO, input
X41	Third BIO, output
X50	4-20mA analog outputs, 4-20mA analog inputs
X51	4-20mA analogue input RS 232 service interface
X52	4-20mA analogue CAN service interface
X60	Modbus RS 485, channel 2; COM L-COM I TX; SPABUS RX
X61	Modbus RS 485, channel 1; COM L-COM I RX; SPABUS TX
X62	Modbus optical, RX channel 1
X63	Modbus optical, TX channel 1
X64	Modbus optical, RX channel 2
X65	Modbus optical, TX channel 2
X70	Ethernet 10Mb/s Rj45
X71	CAN Open ISO11898 connector.
X72	Mainmodule RS 232 service interface
X73	HMI connection
X74	Time synch input
X75	HSTS Input
X76	HSTS Input
X77	HSTS Output
X80	Analogue inputs
X81	Sensor 1
X82	Sensor 2
X83	Sensor 3
X84	Sensor 4
X85	Sensor 5
X86	Sensor 6
X87	Sensor 7
X88	Sensor 8

Figure 45: Connectors table

17.1 Analogue Inputs

REF542*plus* can have a maximum of 8 analogue input channels. These inputs are divided into three measurement groups:

Measurement Group 1: channel 1, channel 2, channel 3

Measurement Group 2: channel 4, channel 5, channel 6

Measurement Group 3: channel 7, channel 8

Group 1 and group 2 have to be homogeneous, which means they can measure 3 currents or 3 voltages. For example, measurements of 1 current and 2 voltages are not allowed.

Group 3 can get any type of signals: 2 currents, 2 voltages, 1 current and 1 voltage, etc. Group 1 and group 2 can be used for homogeneous current or voltage measurements both from instrument transformers and non-conventional sensors. Group 3 can be used in a heterogeneous way.

Channel 7 and 8 in group 3 can be used for earth fault current with CT type input; residual voltage, or for the synchrocheck function with VT or sensor type input.

The input CT 0.2A is commonly used with a toroidal transformer for sensitive earth fault current measurement.

Instrument current transformers can have secondary windings ratio /1A or /5A. The primary nominal current (e.g. 400A) is selected with the Operating Tool. The secondary current (e.g. /5A) is automatically selected connecting the right wire to the analogue input module.

The Rogowsky coil can be used for current sensing. The correct ratio of the Rogowsky coil is selected with the Operating Tool. The resistive divider can be used for voltage sensing. The ratio is selected with the Operating Tool. The physical input on the unit is the same both for voltage and current sensing, the selection is done via the Operating Tool. So, it is possible for example to use 6 Rogowsky coils, or 6 voltage dividers, or 3 Rogowsky coils and 3 voltage dividers.

To detect which analogue input module is present inside the unit, look in the identification label stick on the unit itself or on the HMI service page under the HW identification sub menu.

Figure 46: Connector for sensors analogue input module.

The analogue input for sensor is the same both for voltage and current sensing. To find out whether an input is for current or for voltage, the Operating Tool is needed. X81 corresponds to analogue input 1 (sensor 1 in the Operating Tool), X82 to analogue input 2 (sensor 2 in the Operating Tool) and so forth.

Figure 47: Connector for conventional instrument transformers.

The connector for conventional instrument transformer has twenty-four pins. The following table defines which input is connected to what:

	VT (100–110V)	CT (1–5A)	CT (0.2A)
1	T5/B	T5/2	
2	T3/B	T3/2	
3	T1/B	T1/2	
4	T8/B	T8/2	T8/A
5	T5/R	T5/1	
6	T3/R	T3/3	
7		T1/3	
8	T8/R	T8/3	T8/B
9		T5/3	
10		T3/1	
11	T1/R	T1/1	
12		T8/1	
13		T4/3	
14	T2/B	T2/2	
15		T6/3	
16	T7/B	T7/2	T7/A
17	T4/B	T4/2	
18		T2/3	
19	T6/B	T6/2	
20	T7/R	T7/3	T7/B
21	T4/R	T4/1	
22	T2/R	T2/1	
23	T6/R	T6/1	
24		T7/1	

Figure 48: Connection table for conventional instrument transformers.

B: Black wire for voltage transformer.

R: Red wire for voltage transformer.

1: 1A input for current transformer.

2: Common input for current transformer.

3: 5A input for current transformer.

Example:

To determine the pins for the analogue input module1VCF750170R0817: 3CTs, 3VTs, 1CTs; used with transformers with 1A on the secondary windings.

The following connection must be done:

Analogue input 1; the current transformer for phase 1 must be connected on pins 11 and 3 (common).

Analogue input 2; the current transformer for phase 2 must be connected on pins 22 and 14 (common).

Analogue input 3; the current transformer for phase 3 must be connected on pins 10 and 2 (common).

Analogue input 4; the voltage transformer for phase 1 to earth must be connected on pins 21 and 17.

Analogue input 5; the voltage transformer for phase 2 to earth must be connected on pins 5 and 1.

Analogue input 6; the voltage transformer for phase 3 to earth must be connected on pins 23 and 19.

Analogue input 7, for the toroidal transformer for the residual current must be connected on pins 24 and 16 (common).

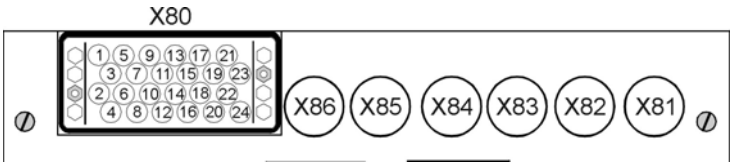


Figure 49: Connector for mixed analogue input module.

The picture above shows the connector for the mixed analogue input module, when both sensors and conventional instrument transformers are used. To find out which connector is used for what, identify the module code from the identification label stick on the unit and look in figure 48 table.

17.2 Binary Inputs and Outputs

Binary inputs and outputs modules use the following connectors:

X20 (inputs), X21 (outputs) for the first module.

X30 (inputs), X31 (outputs) for the second module.

X40 (inputs), X41 (outputs) for the third module, available with the wide housing only.

REF542*plus* can be equipped with two different types of binary inputs and outputs modules: static or with electromechanical relays.

17.2.1 Static

In the static module, digital inputs are implemented with optocouplers and digital outputs are implemented with power transistors. Two different module types are available, with control coil continuity and without.

Each module features: 14 digital inputs, 3 power outputs, 4 normal outputs, 2 signal outputs, 1 watchdog output and optionally 2 coil supervision circuits. More details can be found in the REF542*plus* technical catalogue.

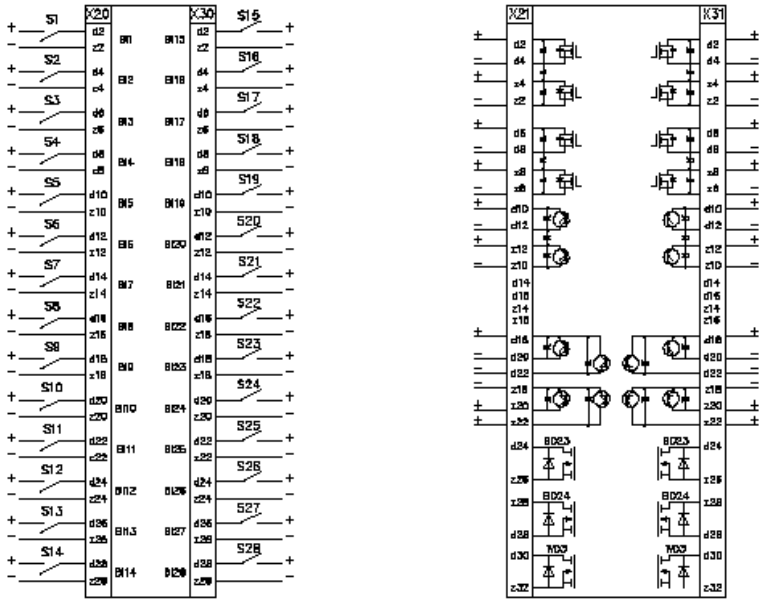


Figure 50: Two static binary inputs and output modules.

17.2.2 Electromechanical

In the electromechanical module, digital inputs are implemented with opto-couplers and digital outputs are implemented with electromechanical relays.

REF542*plus* can be equipped with 2 different electromechanical module types, BIO2 and BIO3. The modules are functionally equivalent, with slight variations. These modules are available in different versions. More details can be found in the REF542*plus* Technical catalogue.

17.2.2.1 BIO3

Eight different types of BIO3 are available, depending upon the supply voltage and other features.

BIO3 Code	Description
1VCF750132R0801	Binary I/O3 20...90 VDC Standard
1VCF 750132R0803	Binary I/O3 20...90 VDC with Static Channel
1VCF 750161R0801	Binary I/O3 20...90 VDC Standard with interconnected '-' on inputs
1VCF 750161R0803	Binary I/O3 20...90 VDC with Static output and with interconnected '-' on inputs
1VCF 750132R0802	Binary I/O3 80...250 VDC Standard
1VCF 750132R0804	Binary I/O3 80...250 VDC with Static Channel
1VCF 750161R0802	Binary I/O3 80...250 VDC Standard with interconnected '-' on inputs
1VCF 750161R0804	Binary I/O3 80...250 VDC with Static output and with interconnected '-' on inputs

Figure 51: BIO3 types and codes.

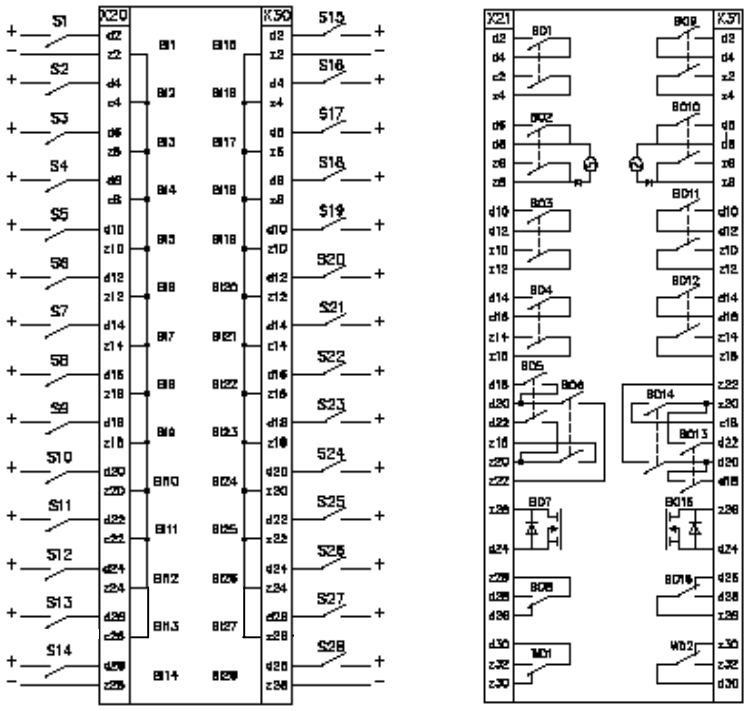


Figure 52: 2 BIO3 modules with interconnected inputs and the static output.

17.2.2.2 BIO2

Two types of BIO2 are available, with and without static channel.

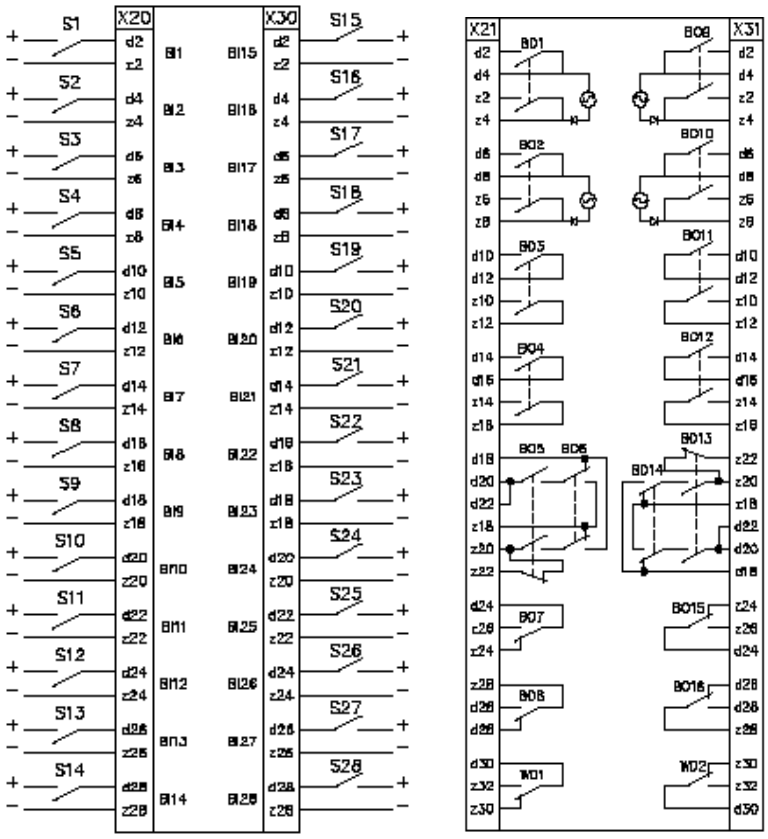


Figure 53: 2 BIO2 modules without the static output.

17.3 Other connections

17.3.1 Analogue outputs 4-20 mA

The 4 analogue outputs, when present, are available at connector X50, accordingly to the following diagram. The not used pins, including the shielding of the cable, are connected to ground.

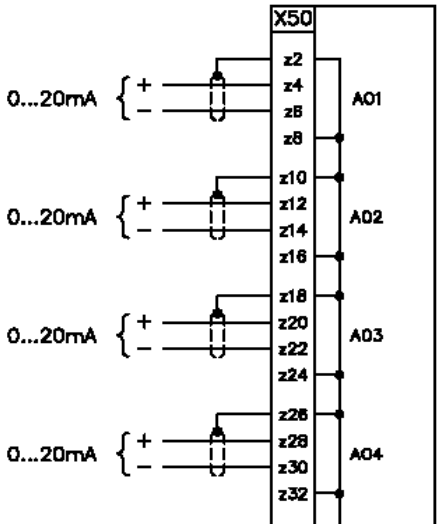


Figure 54: 4-20mA Analogue Outputs.

17.3.2 Analogue inputs 4-20 mA

When present, the 4-20ma analogue input module uses connector X50. Sensors connections are shown in the picture below. X51 and X52 are service interfaces, of no use for the user. The output contact BO1 is for future use.

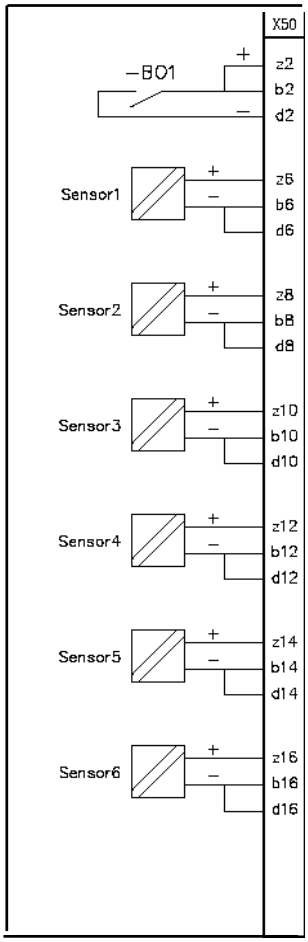


Figure 55: 4-20mA Analogue inputs.

Note

Only passive sensors, e.g. which are powered from the loop can be connected to the 4…20mA analogue input module.

17.3.3 Communication module

The communication module uses connectors from X60, X61, X62, X63, X64 and X65, depending upon the physical media type (RS 845, glass or plastic fiber).

17.3.4 Power supply

Power supply for the Base Unit is X10.

17.3.5 Time Synchronization

The optical Input for time synchronization is X74.

17.3.6 HMI

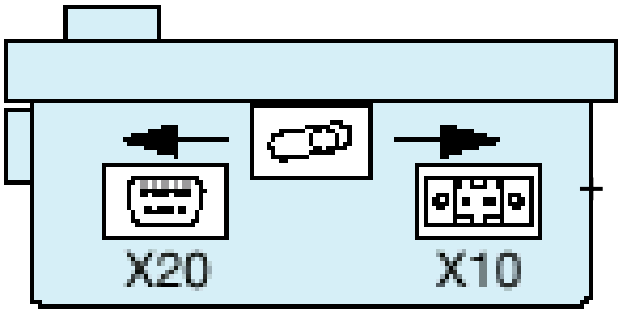


Figure 56: HMI connectors.

The HMI power supply is X10 (1 is +, 2 is -), while the serial cable to connect the Base Unit must be connected on X20.

Note

Respect the right polarity on the HMI power supply, to avoid damages to the unit.

18 Appendix B: Menu structure

The following paragraph illustrates the HMI menu structure with sub menus not described in the document.

To access the menu structure, press < **Menu** >.

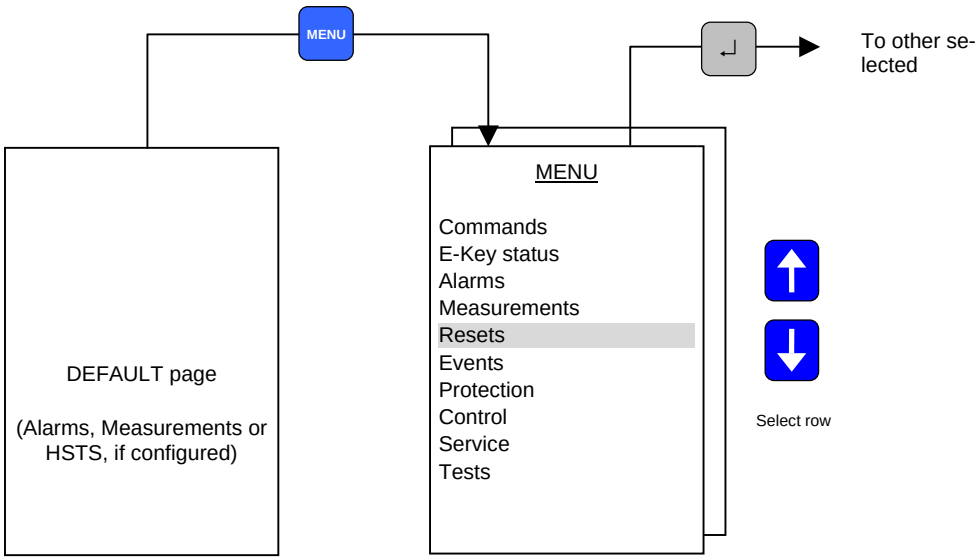


Figure 57: REF542*plus* menu.

The access to some sub menus is restricted to a few operating modes, as described in the access table below:

Menu / Sub menu page	**No Control**	**Local Control**	**Remote Control**	**L & R Control**	**Prot. Set**	**Prot. Oper.**
E-Key Status	Yes	Yes	Yes	Yes	Yes	Yes
Measurements	Yes	Yes	Yes	Yes	Yes	Yes
Alarms	Yes	Yes	Yes	Yes	Yes	Yes
Reset page – Alarm - max. values – energy values - CB cycles - fault recorder - Start/Trip – counters	 - - - - - - -	 - - - - - - -	 - - - - - - -	 - - - - - -	 Yes No No No Yes Yes No	 Yes No No No No No No
Start/Trip page	Yes	Yes	Yes	Yes	Yes	Yes
Active set page - View pameter – Change set	 Yes No	 Yes No	 Yes no	 Yes No	 Yes Yes	 Yes No
Protection functions - View Parameter – Change Parameter	 Yes -	 Yes -	 Yes -	 Yes -	 Yes Yes	 Yes No

Menu / Sub menu page	No Control	Local Control	Remote Control	L & R Control	Prot. Set	Prot. Oper.
Control parameters						
-View Parameter	-	-	-	-	Yes	Yes
–Change parameter	-	-	-	-	Yes	No
Service Page						
– Statistics	Yes	Yes	Yes	Yes	Yes	Yes
– Versions	Yes	Yes	Yes	Yes	Yes	Yes
– Communication adress	Yes	Yes	Yes	Yes	Yes	Yes
- LCD contrast	Yes	Yes	Yes	Yes	Yes	Yes
- MC time	Yes	Yes	Yes	Yes	Yes	Yes
- Load flow direction	Yes	Yes	Yes	Yes	Yes	Yes
– Autoreclosure mode	No	No	No	No	Yes	No
- IEC 60870-5-103 module	Yes	Yes	Yes	Yes	No	No
Test Page						
- HMI Control Unit	Yes	Yes	Yes	Yes	Yes	Yes
– Primary	No	Yes	No	No	No	No

Figure 58: Menu access table.

18.1 Reset Page

From this page, it is possible to reset alarms and other quantities. Some reset actions are possible only if the REF542*plus* is in the proper mode. For example, the fault recorder can be reset only in the set protection mode. An attempt to reset it in the operational mode will be denied.

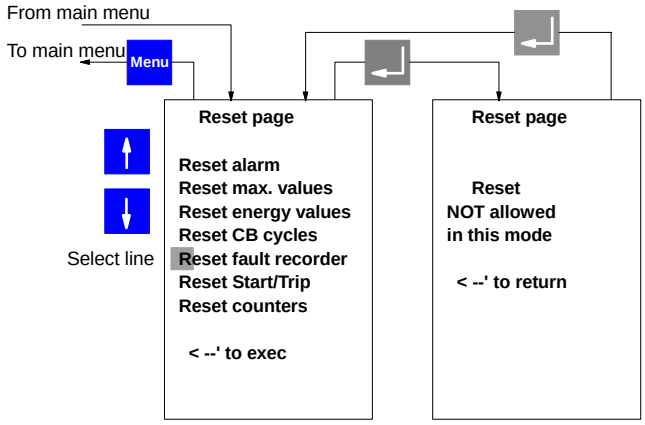


Figure 59: Attempt to resetting the fault recorder in the wrong mode.

Select the quantity to reset with UP <↑> and DOWN <↓> and press ENTER **< <-' >** to execute.

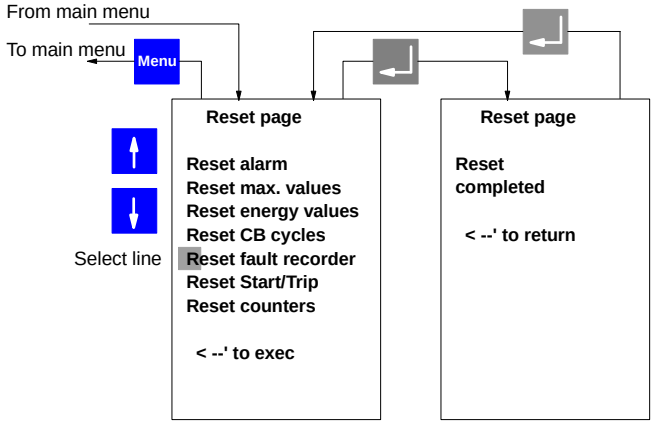


Figure 60: Resetting a quantity in the proper mode.

The quantities that can be reset are:

Reset alarm: only not anymore active alarms can be reset. An attempt to reset an alarm caused for example by an interrupted open coil is impossible, as long as the coil is not replaced.

Reset max. values: this sub menu resets the maximum and mean current values in the observation period. Also the sum of switched off current is reset from here.

Reset energy values: all the energy values (active, reactive, apparent) are reset from here.

Reset CB cycles: a circuit breaker cycle is a close operation and the subsequent open operation. The unit sums the cycles. This cycle number is reset from here.

Reset fault recorder: the fault recorder data are cleared from here.

Reset Start/Trip: the start and trip protection events are cleared from here.

Reset counters: The unit working hours are reset from here.

18.2 Service page

The service page menu is composed of several sub-menus. Browse through the sub-menus with UP <↑>, and DOWN <↓>. Press ENTER **< <-' >** to enter the selected sub menu.

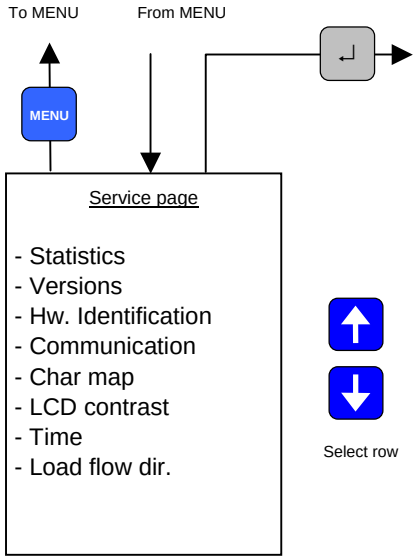


Figure 61: Service page menu.

The service page contains the following submenus.

Statistics

This sub-menu shows the FUPLA cycle time and other information related to the current configuration in the unit.

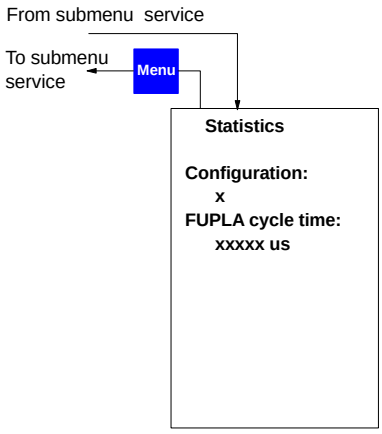


Figure 62: Statistics submenu.

Versions

This sub-menu displays information on the firmware versions loaded inside the unit.

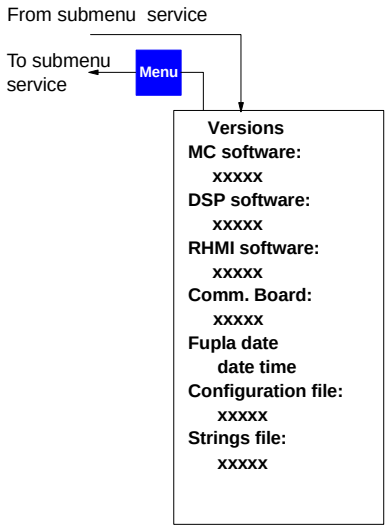


Figure 63: Versions sub-menu.

Hardware identification

This sub-menu show the reference information of the hardware modules installed into the REF542*plus*.

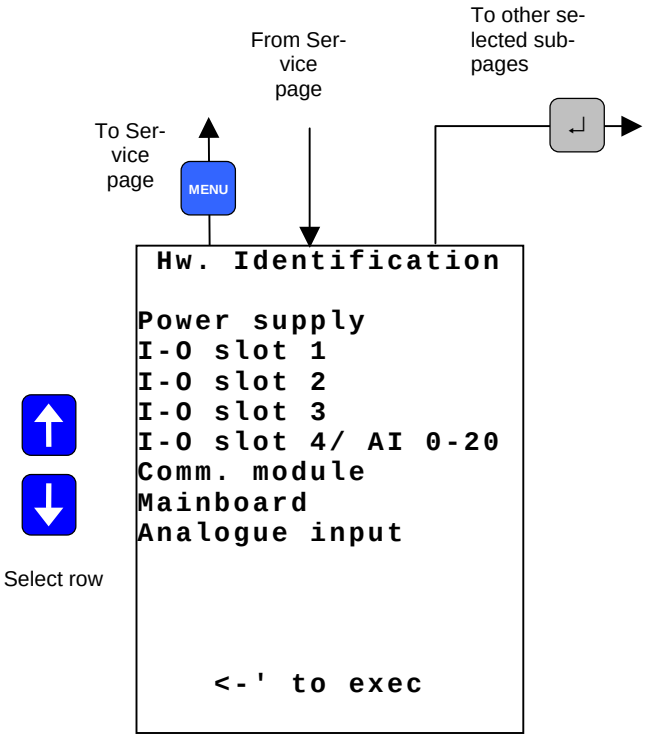


Figure 64: Versions sub-menu

Hardware information page

To display the information select the row and press ENTER **< <-' >** When the information is available in the selected module the following page will be displayed (this information is stored in a dedicated EEPROM on the module itself).

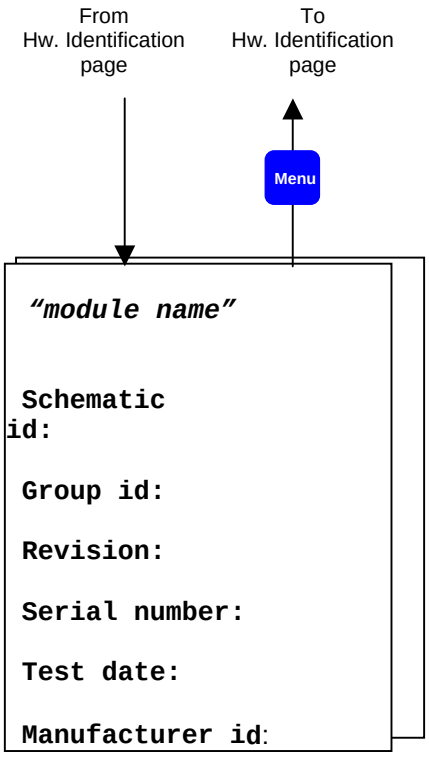


Figure 65: hardware information page

When the information from the module is not available the following page is displayed.

Figure 66: hardware information is not available

When the information stored on the module is corrupted the following page is displayed.

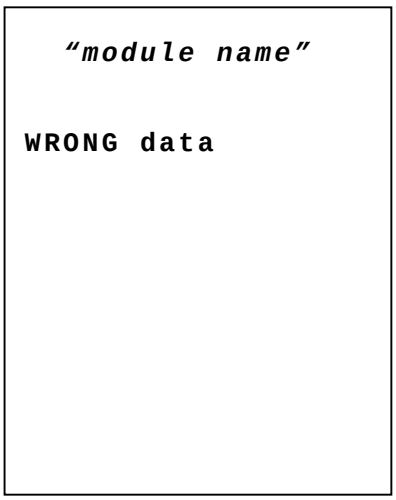


Figure 67: hardware information corrupted

When the module is not present or the module is not able to publish the HW identification data the following page is displayed.

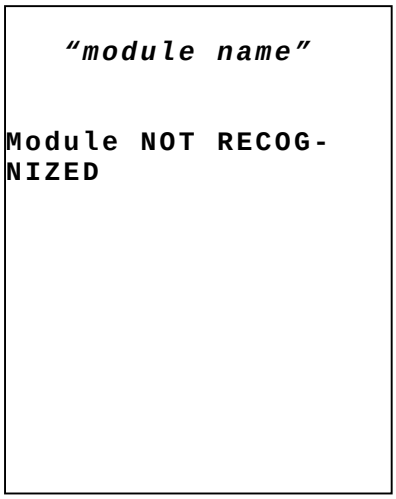


Figure 68: hardware information not available

Communication

This sub page displays the information related to the communication ports available and configured in the REF542*plus*.

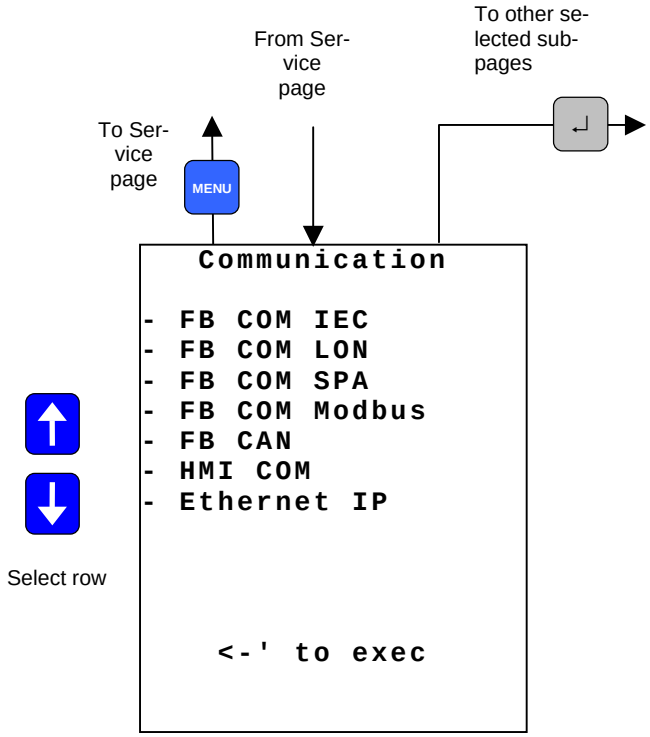


Figure 69: Communication sub page visualization.

When the port is not installed or configured the following page will be displayed.

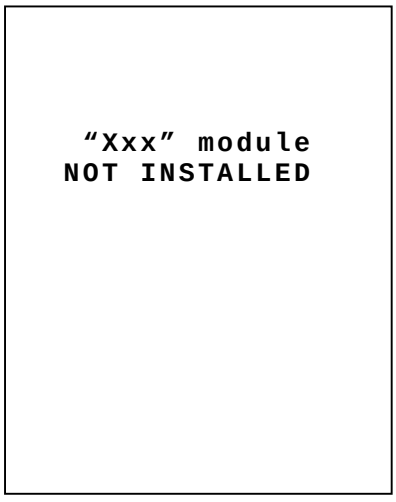


Figure 70: Communication module is not installed.

When the COM-L module for LON communication is installed and active the following page displays the configured Node ID.

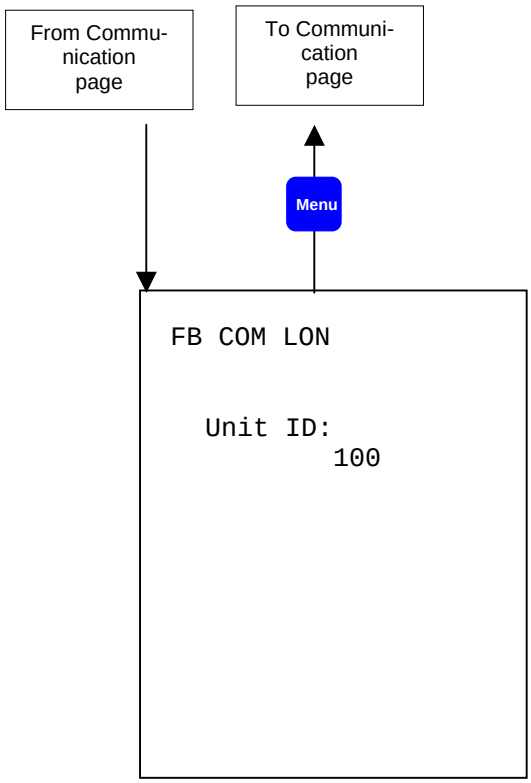


Figure 71: LON communication module Node Id.

When the Modbus module is installed and properly working the following page is displayed.

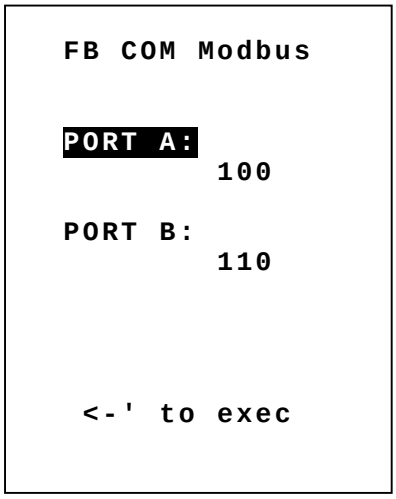


Figure 72: Modbus communication module page.

Selecting the row related to port A or B and pressing ↵ it is possible to change the port communication address.

IEC Communication page

When the IEC60870-103 communication module is installed the following page is displayed.

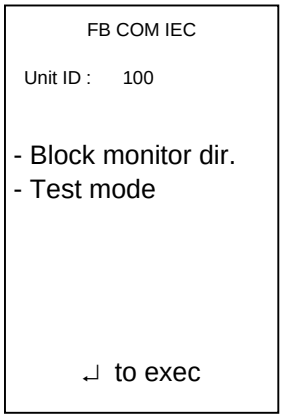


Figure 73: IEC 103 communication module page.

In this sub-page it is possible to block the monitoring direction of the module. For more information see also the communication module user manual.

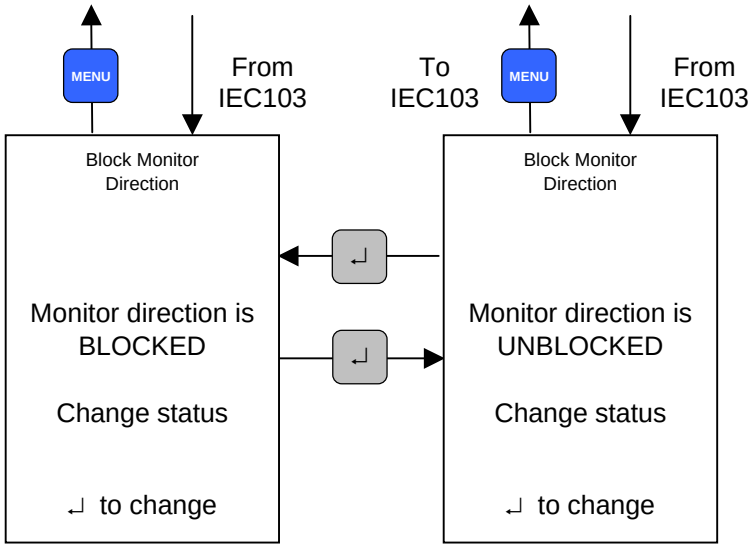


Figure 74: IEC 103 communication, blocking the monitoring direction.

The IEC Test mode menu allows setting and resetting the test mode of the IEC module. For more information see also the communication module user manual.

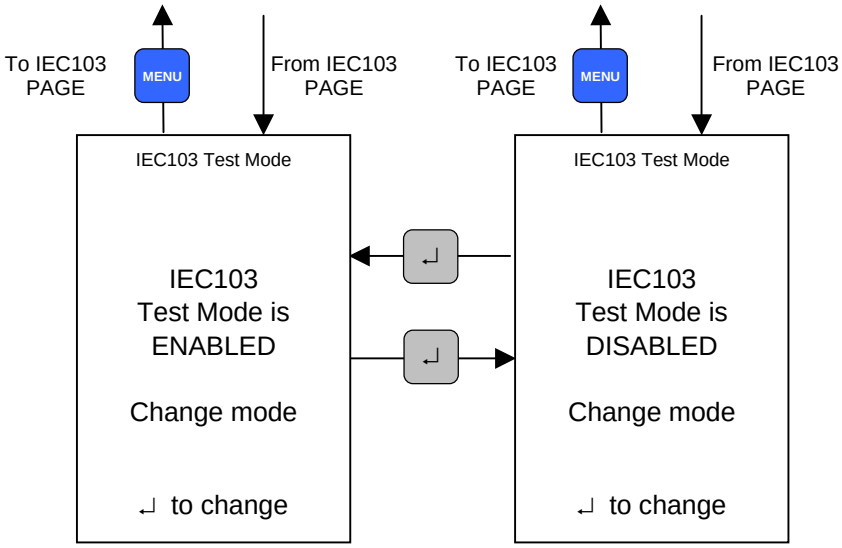


Figure 75: IEC 103 communication module test mode sub-page.

SPA bus communication sub-page

When the SPAbus communication module is installed the following page is displayed.

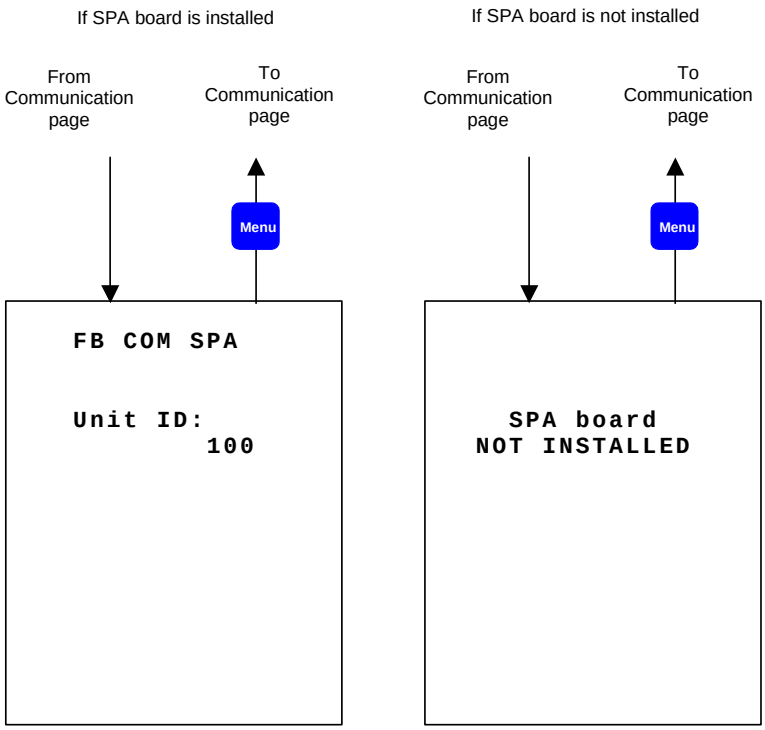


Figure 76: Spabus communication module page.

Is not possible to modify the SPA bus slave address of the unit by this page.

CAN Communication sub-page

When the CAN port has been enabled the following pages display the CAN communication settings.

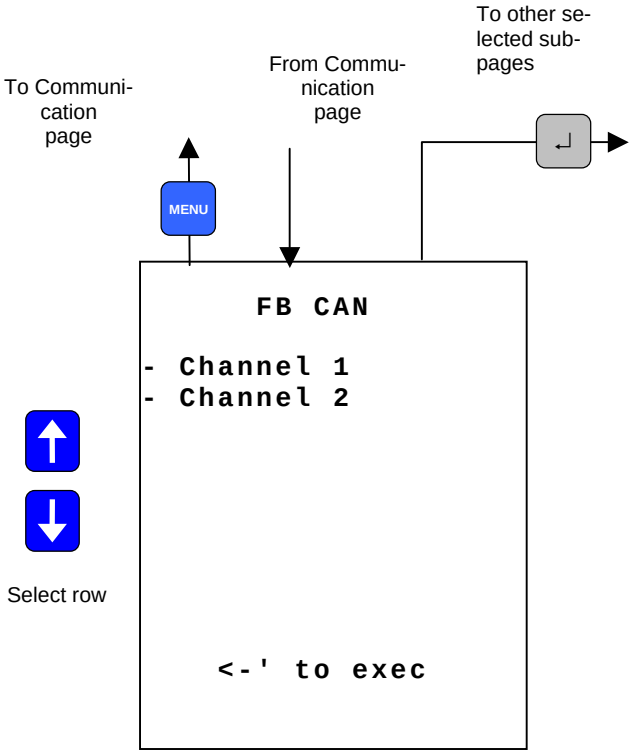


Figure 77: CAN communication port page.

Only channel 1 is currently available. To enter the next sub page select Channel1 and press ENTER **< <-' >**. The following page is displayed.

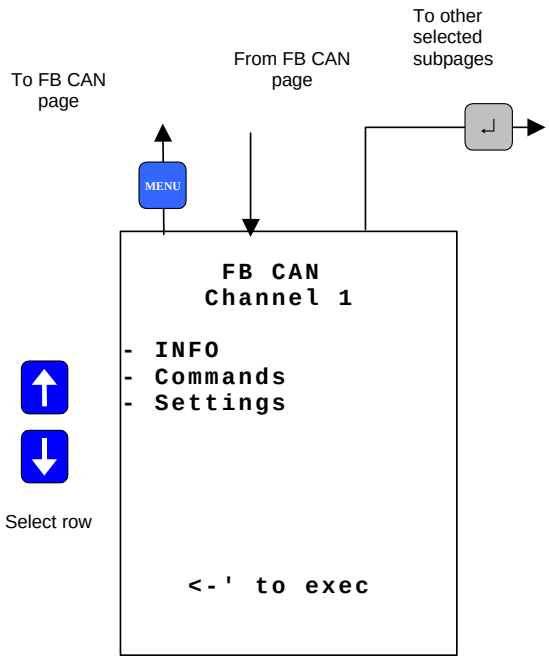


Figure 78: CAN communication port sub-page.

CAN INFO sub page

This page displays the CAN status information.

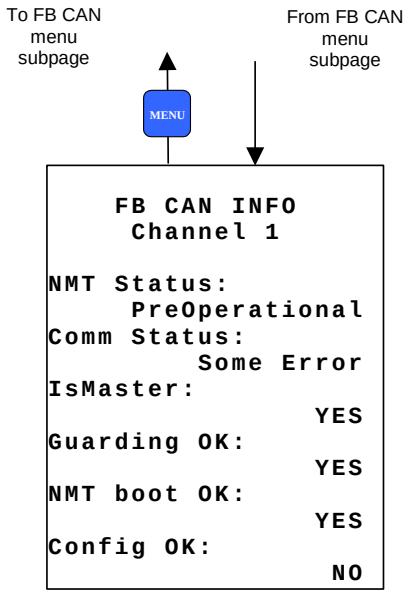


Figure 79: CAN communication port sub-page.

CAN Commands sub page

From this page it is possible to issue direct operation to the CAN communication subsystem. For more information see also the CAN communication user manual.

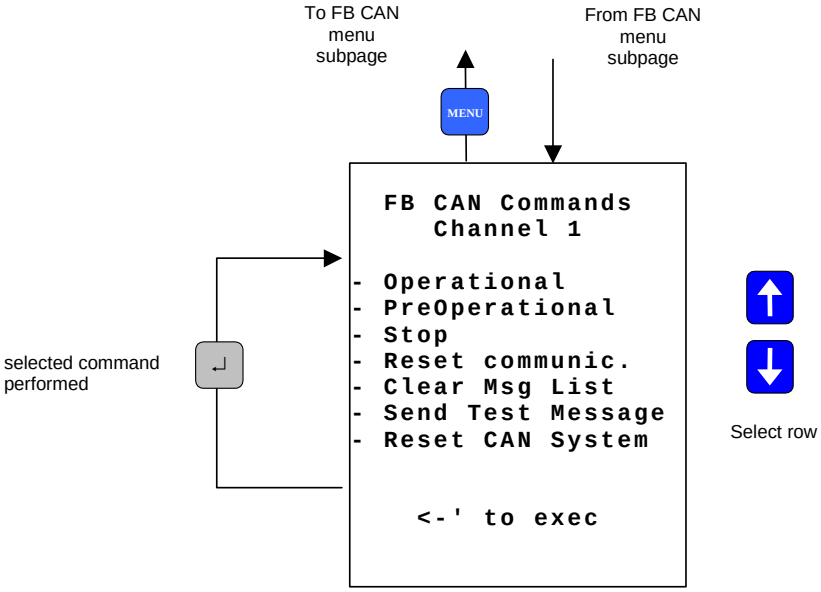


Figure 80: CAN communication port sub-page.

CAN Setting sub page

In this page it is possible to change the node address of the CAN communication. This setting is allowed only when the REF542*plus* node is in Pre-Operational status.

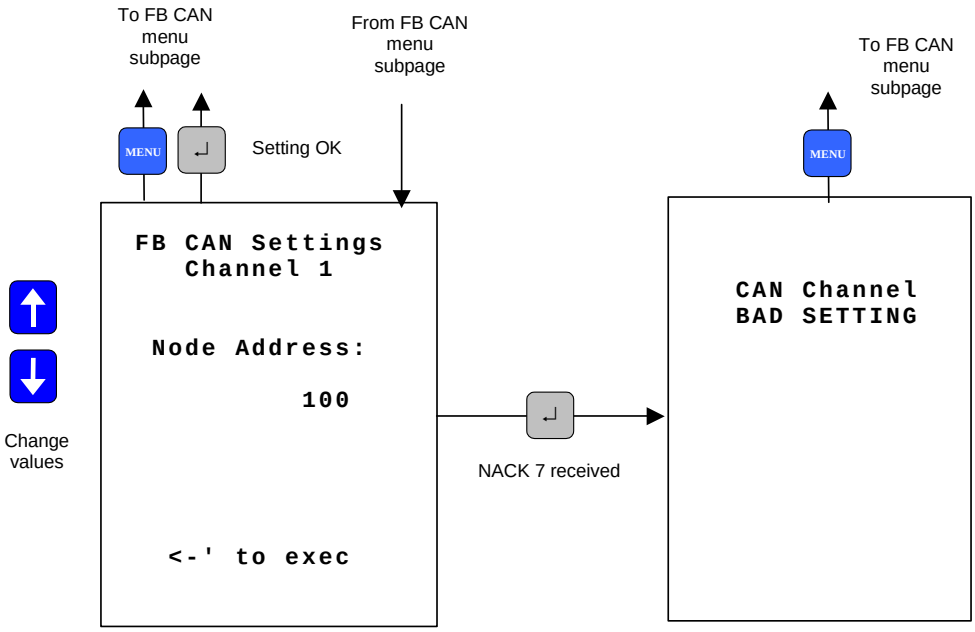


Figure 81: CAN communication port sub-page.

HMI Communication sub-page

In this page it is possible to change the Base Unit slave address used to communicate with the HMI.

Note

When the Base Unit address is changed, the communication with the HMI is lost. To restore it, the Base Unit address must be inserted in the HMI as well. Select the menu item Base Unit Slave Address and insert the same address of the Base Unit.

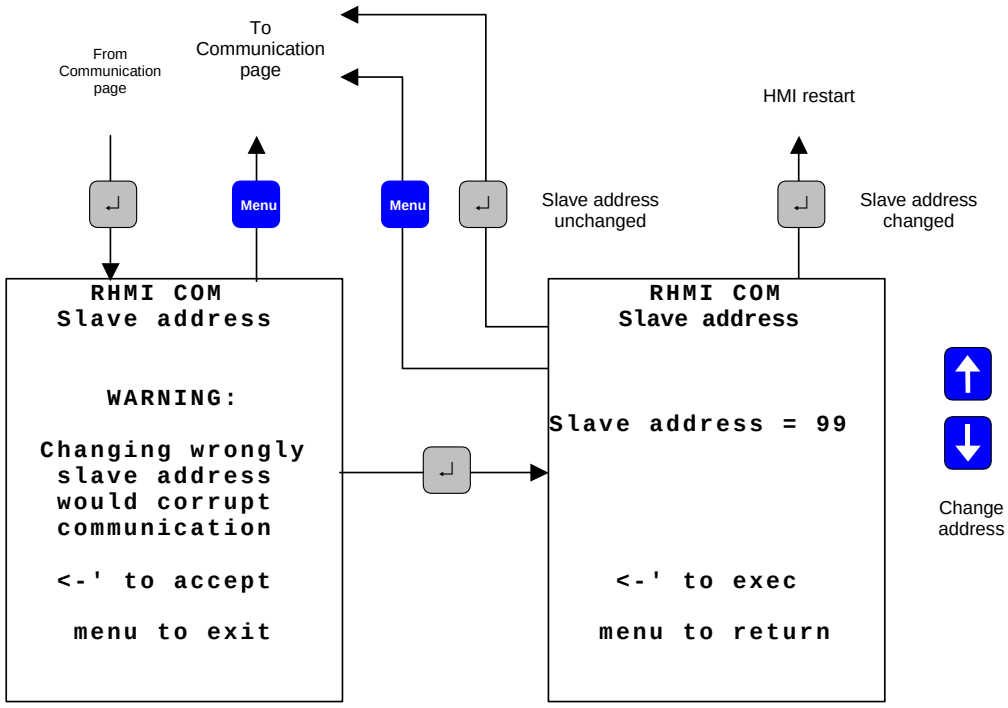


Figure 82: HMI, changing Base Unit address to be polled.

Ethernet communication sub-page

This page shows the current settings of the Ethernet communication sub-system. Here it is possible to visualize the IP and MAC address. IP and Mac addresses cannot be changed from this page.

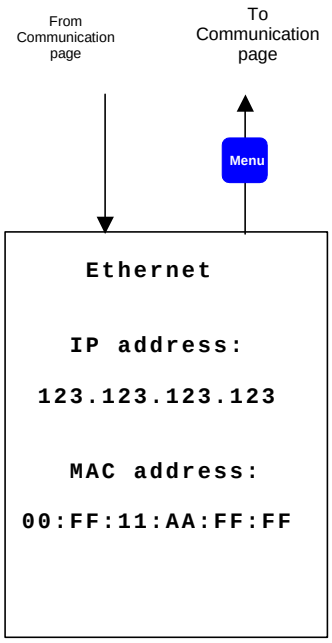


Figure 83: Ethernet port sub-page.

Char map

This page shows the active char map used by the HMI. Refer to the Operating Tool User Manual to change it.

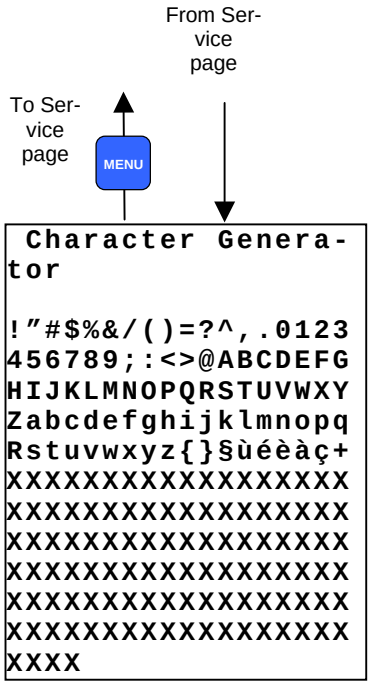


Figure 84: Char map page.

LCD contrast

The LCD screen contrast can be adapted to different light condition from this sub menu.

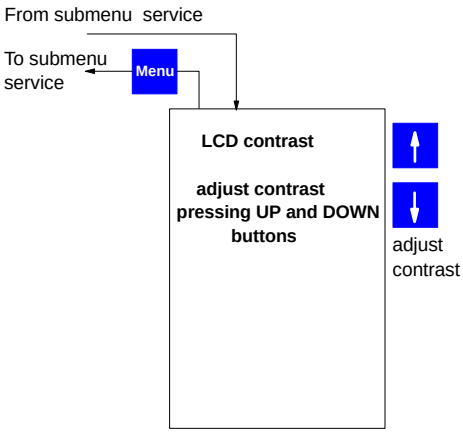


Figure 85: Adjusting the LCD contrast.

Load Flow direction

The load flow direction determines how the REF542*plus* computes energy and power. It is set with the Operating Tool and it is also dependent upon the current and voltage transformers (or sensors) connections in the primary parts.

- FORWARD: the power is flowing from the switchgear to the load (out-going feeder).
- BACKWARD: the power is flowing into the switchgear (incoming feeder).

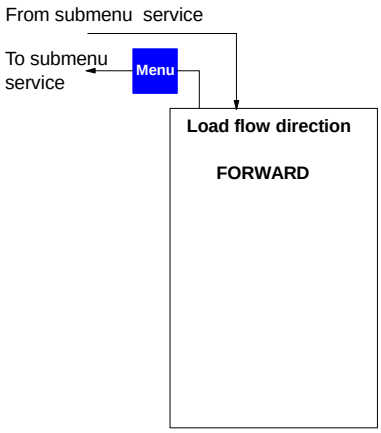


Figure 86: Load flow direction visualization.

18.3 Test page

This sub menu allows testing the HMI and the primary part of the switchgear.

18.3.1 Test HMI

When the test HMI is selected, all its features will be tested switching them on and off.

Note

HMI buttons are not available during the test. The displayed information on the HMI does not reflect the switchgear actual status. REF542*plus* is protecting the switchgear during the HMI test. The HMI test takes a few seconds.

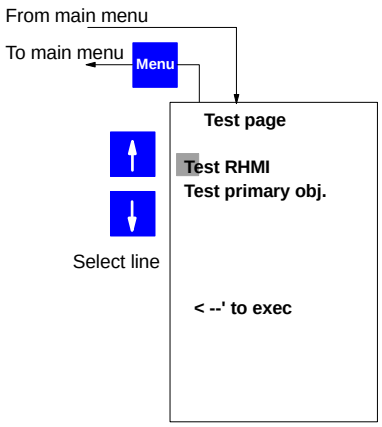


Figure 87: Test page menu.

18.3.2 Test primary object

The circuit breaker and other switching devices can be tested from this sub menu. The object control buttons are used to perform the desired tests. A warning message is displayed before leaving the test primary objec. mode.

Warning!

In test mode, interlockings are disabled. It is strongly recommended to de-energize the switchgear before activating the test mode.
Verify primary objects correct position before leaving the test mode and before energizing the switchgear. Be sure all the primary objects are back in the correct positions.

19 Appendix C :Tripping time indication

The example below indicates explain tripping time indication on REF542*plus* HMI. The example refers the overcurrent instantaneous protection function.

Setting values in the REF542*plus* are:

Set time=80ms

Set threshold = 0,1In

Event nr.1

The protection function enters the start condition (e.g. the current is above the set threshold) at 01/01/2004, 16:02:22.138, absolute time. The yellow arrow indicates the time.

Event nr. 3

The set time has elapsed with the current above the set threshold so the trip signal is generated at 01/01/2004, 16:02:22.203, absolute time. The red arrow indicates the time.

The set time in the REF542*plus*, 80ms in this case, must be compared to the time obtained by the following computation:

(Trip signal time: event nr. 3 time)-(start time: event nr.1 time)+compensation time(*)

In this specific case assuming a BIO3 module inside the REF542*plus*:

203ms-138ms+15ms=80ms.

The time "Start L1", 5'028ms long, indicated by the blue arrow, is the time interval during which the protection remains in the start state (e.g. active) inside the REF542*plus*.

(*)The compensation time takes into account the signal processing inside the unit and switching time of the contact. The values for the different modules are:

Static IO module 10ms

BIO3 module 15ms

BIO2 module 20ms.

20 Glossary index

21 Appendix D: Product Information

Product Information	
ABB Australia Pty Limited Medium Voltage Power Technology Products Division Bapaume Road, Moorebank NSW 2170, Australia Phone: +61 2 9821 0111 Fax: +61 2 9602 2454 E-mail: abbptmv.aus@au.abb.com internet: http://www.abb.com/au	ABB Secheron SA Medium Voltage Rue des Sablieres 4-6 CH – 1217 Meyrin Switzerland Phone: +41 22 306 2646 Fax: +41 22 306 2682 E-mail: info.secheron@ch.abb.com Internet: http://www.abb.ch
ABB Xiamen Switchgear Co. Ltd. ABB Industrial Park Torch Hi-tech.Development Zone Xiamen, Fujian, P.R.of China Phone: +86 (0)592 6026033 Fax: +86 (0)592 6030505 Internet: http://abbcndmx.com.cn	ABB s.r.o. MV Switchgear Videnska 117 61900 Brno Czech Republic Phone: +420 5 4715 2413 Fax: +420 5 4715 2190 E-mail: info.ejf@cz.abb.com Internet: http://www.abb.com
ABB Calor Emag Mittelspannung GmbH Product Management Oberhausener Straße. 33 40472 Ratingen Germany Phone: +49 2102 12 1901 Fax: +49 2102 12 1808 1901 E-mail: calor.info@de.abb.com Internet: http://www.abb.de/calor	ABB Arab S.A.E Medium voltage department Industrial Zone - B1, 10 th of Ramadan City , Egypt. Phone: +20 15 36 1288 Fax: +20 15 36 1642 Internet: http://www.abb.com/eg
ABB Limited - Design & Development MV Switchgear Division plot No. 79 Street No. 17 Nashik -PIN- 422007 India Phone: +91 0253 2351095 Fax: +91 0253 2350644 Internet: http://www.abb.com	

Product Information

ABB T&D S.p.A, Unita' Operativa
SACE T.M.S.
Product Management
Via Friuli 4
I-24044 Dalmine (BG)
Italy

Phone: +39 035 395 710
Fax: +39 035 395689
E-mail: sacetms.tipm@it.abb.com
Internet: http://www.abb.com

ABB Ltd.
Power Technology Medium Voltage
513 Sungsung-dong (Chonan Foreign Invested-Enterprises Industrial Park)
Chonan, Chungchong-namdo, Post 330-300
Korea

Phone: +82 41 529 2458
Fax: +82 41 529 2500
E-mail: swgr.info@kr.abb.com
Internet: http://www.abb.com.kr

ABB Transmission & Distribution Sdn. Bhd.
Manufacturing
Lot 608, Jalan SS 13/1K
47500 Subang Jaya, Petaling Jaya
Selanggor Darul Ehsan
Malaysia

Phone: +603 5628 4888
Internet: http://www.abb.com

ABB Elektrik Sanayi A.S.
Medium Voltage Technology
Power Technology Products Turkey
Design&Order Handling
Organize Sanayi Bölgesi 2. Cadde No:16
Yukar Dudullu 81260 Istanbul
Turkey

Phone : +90 216 528 20 00
Fax : +90 216 365 29 43
Internet: http://www.abb.com