MANUFACTURER DOCUMENT PACKAGE

Manufacturer's Manual

Amikon cover with selected official ABB pages

REF 542PLUS

REF542 PLUS 76A3NDNN36ESU31

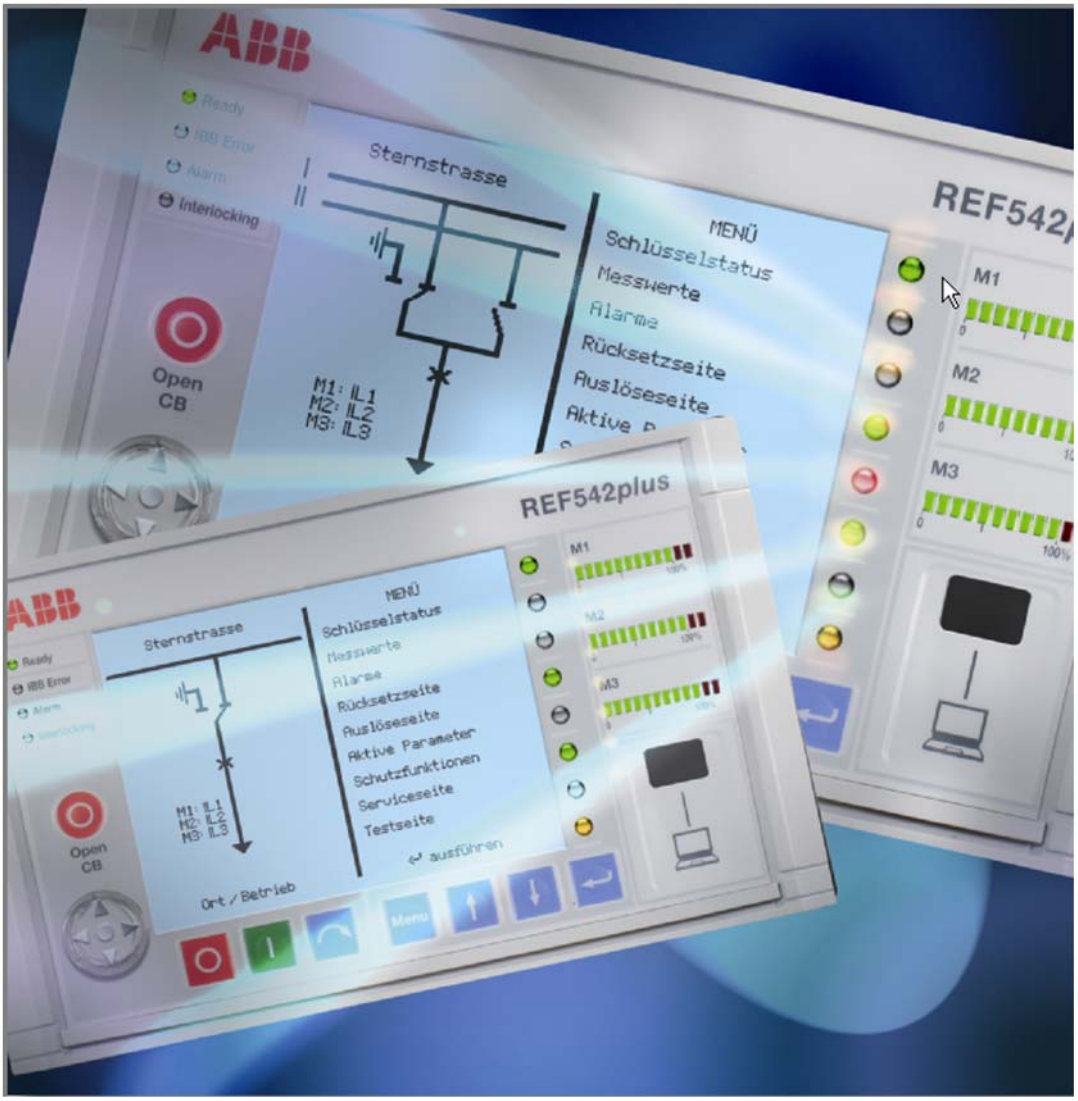
CONFIGURED FEEDER PROTECTION AND CONTROL TERMINAL

OFFICIAL SOURCES

ABB REF 542plus Technical Reference Manual 1MRS755859, ordering tables 7-1 to 7-14. Selected pages retain their original content, color and aspect ratio.

REF 542plus

Technical Reference Manual



1. Introduction

1.1. This manual

This manual provides thorough information on the protection relay REF 542plus and its applications, focusing on giving a technical description of the relay.

1.2. Use of symbols

This publication includes the following icons that point out safety-related conditions or other important information:



The electrical warning icon indicates the presence of a hazard which could result in electrical shock.



The warning icon indicates the presence of a hazard which could result in personal injury.



The caution icon indicates important information or warning related to the concept discussed in the text. It might indicate the presence of a hazard which could result in corruption of software or damage to equipment or property.



The information icon alerts the reader to relevant facts and conditions.

Although warning hazards are related to personal injury, it should be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process performance leading to personal injury or death. Therefore, comply fully with all warning and caution notices.

1.3. Intended audience

This manual is intended for operators and engineers to support normal use of as well as configuration of the product.

2. Safety information



Dangerous voltages can occur on the connectors, even though the auxiliary voltage has been disconnected.

Non-observance can result in death, personal injury or substantial property damage.

Only a competent electrician is allowed to carry out the electrical installation.

National and local electrical safety regulations must always be followed.

The frame of the device has to be carefully earthed.



The device contains components which are sensitive to electrostatic discharge. Unnecessary touching of electronic components must therefore be avoided.

3. General

REF 542plus is a Switchgear Multifunction Protection and Switchgear Control Unit and it is the further development of the former REF 542 multifunctional unit. Like its predecessor, it features the following functions:

- Protection
- Measurement
- Control
- Monitoring and self diagnosis
- Communication

All above-mentioned and also power quality functions are integrated into a programmable environment. The exceptional flexibility and scalability of this new generation device lead to a smart solution where the traditional approach would be ineffective and expensive.

The following figures Fig. 3.-1 and Fig. 3.-2 show examples of the REF 542plus installation in several switchgears.



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Fig. 3.-1 REF 542plus installed in gas-insulated switchgear (GIS)

4. Functions

REF 542plus switchgear protection and control unit integrates all secondary functions in a single unit. This multifunctional unit features also a self-monitoring function. All functions are designed as freely configurable software modules. Therefore, a wide range of operation requirements in MV stations can be met without any problems. The versatility of the software makes it possible to use the REF 542plus on every switchgear irrespective of the specific application required.

4.1. Configuration

The REF 542plus unit is configured for the specific application using the Operating Tool running on a personal computer. With the graphical editor, the needed functions blocks are combined together. The available protection functions are represented with specific function blocks, which can be combined with logic function to define the required protection and automation scheme. The flexibility of REF 542plus is advantageous for defining control functions and automation sequences which can, for example, include the interlocking of the switching devices, blocking the release of specific protection functions, as well as starting switching sequences.

The REF 542plus unit provides a wide range of logical functions so that each specific requirement can be met. The functions include logical gates such as AND, OR, timers, counters, pulse generators, flip-flops and so on. All functions in the switchgear are specified in collaboration with ABB. The REF 542plus configuration is a file which is then downloaded into the unit via the optical serial port on the HMI or via Ethernet TCP/IP port. The Operating Tool allows also these additional functions once connected to the HMI via the serial cable:

- Protection functions setting
- Measurement values read-out
- Online binary inputs and outputs status read-out
- Fault recorder data acquisition

The Operating Tool allows an online, real-time monitoring of the internal control signals and logic states, a powerful tool for application debugging.



The specific software configuration of the required protection scheme can only be carried out in-house at ABB.

4.2. Measurement

REF 542plus can have a maximum of 8 analog input channels for measuring current and voltage signals. These channels are organized into three groups.

4.4. Control

The control and automation capabilities inside the REF 542plus are extremely powerful. Simple interlocking against switching errors as well complex load-shedding schemes can be easily implemented with the control possibilities offered by the REF 542plus.

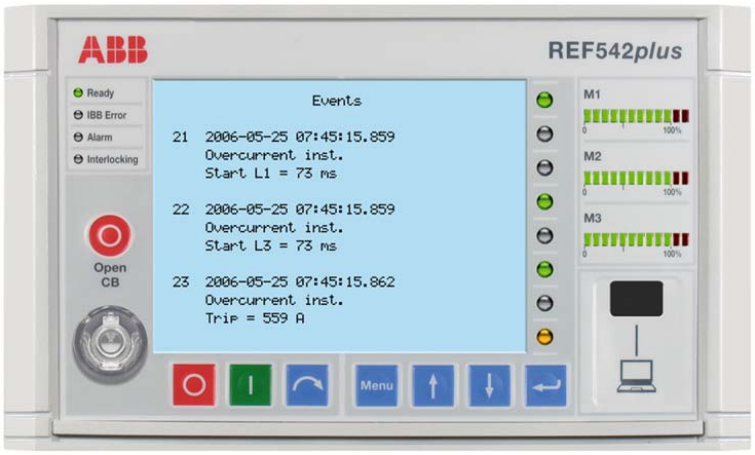
It is also possible to implement interlocking between the switchgear connected to the same busbar system. This requires the availability of status information of the switching devices to and from other switchgear. The status information must be provided by:

- Conventional, hard-wired ring bus system
- Using the ABB station automation system with ABB LON protocol per LAG 1.4, which allows horizontal communication among the REF 542plus units connected on the interbay bus
- Using the CAN Open digital fieldbus (only to be applied by the ABB switchgear companies)

The REF 542plus foresees different control modes, selectable with the control key. In local mode, the HMI control buttons are used to operate on the primary objects. Remote operations are inhibited. In remote control mode, only switching actions from a remote control device like a station automation system are permitted. Local control from the HMI is inhibited. All possibilities to operate on the primary objects can be inhibited by setting the unit to the no control mode.

4.5. Event recording

The last 30 recorded events can be shown locally on the HMI. Most of the events are related to protection activities. In addition to displaying the event name, additional information about the event, time, date and the RMS value of the short-circuit current switched off by the CB are provided. Each event is stamped with the time and the date. Events are stored in non-volatile memory, so they are maintained also in case of a power loss.



A050403

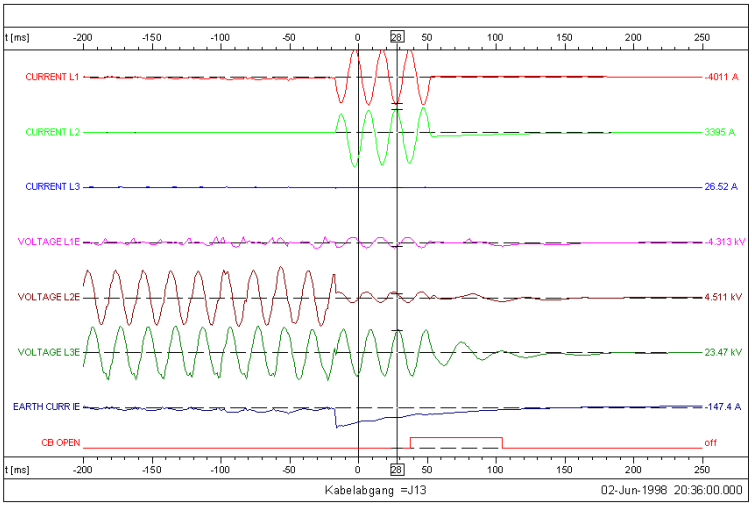
Fig. 4.5.-1 Event list on the LCD of the HMI

4.6. Fault recorder

The REF 542plus unit is equipped with a powerful and flexible fault recorder function. This function can be used to record at most eight analog input channels and thirty-two binary signals. The analog input signals are recorded with a sampling rate of 1.2 kHz for a time interval of at least 1 second and for a maximum of 5 seconds. The recording time is a combination of pre- and post-fault time. The total recording capability is 5 seconds. There can then be configured 5 records of 1 seconds or a single record of 5 seconds. The recording can be started by a protection event, by a binary signal change or by any user-defined condition.

Fault records can be transferred locally to a personal computer from the HMI optical port with the Operating Tool on from the communication interface. When extracted with the Operating Tool, the fault records are automatically converted into the standard COMTRADE format. When retrieved from the communication interface, they can be converted with a utility program. Fault records are stored in non-volatile memory, so they remain available also after a power failure.

Fault records can be exported and converted with the configuration software. The transfer of fault records can be done also via the interbay. Fig. 4.6.-1 shows a record of a cross-country fault in an earth-fault compensated MV system starting with the earth fault.



A050404

Fig. 4.6.-1 Record of a cross-country fault in MV system

4.7. Time synchronization

REF 542plus is equipped with an internal real-time clock, which is used to time stamp events. The internal clock is buffered by a special capacitor. In case of a DC power supply failure, the stored electrical energy in the capacitor ensures continued operation of the internal clock for at least another two hours. The date and time of the clock can be set via the HMI control unit.

REF 542plus internal clock can be kept in synchronization with an external clock in different ways.

When connected to an ABB station automation system, REF 542plus is synchronized via an interbay bus using the facilities of, for example, SPA protocol or ABB LON per LAG 1.4 protocol. For connection to third party system the standard protocol IEC 60870-5-103, IEC 61850 or modified Modbus RTU protocol are available. If better accuracy is required, REF 542plus can be synchronized using the dedicated IRIG-B optical input port and a GPS master clock. The accepted timeformats are IRIG format B 000, B002 and B003. The Fig. 4.7.-1 shows the time distribution architecture for the synchronization.

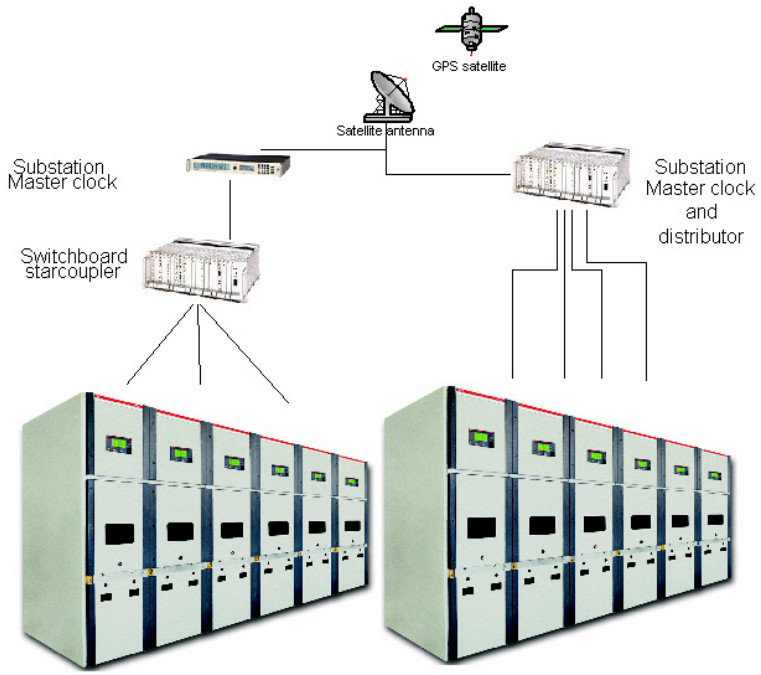


Fig. 4.7.-1 Synchronization of the internal clock by a GPS master clock

4.8. Interface to the primary process

The REF 542plus offers a flexible interface to the primary process which is described in the following sections.

4.8.1. Analog inputs

REF 542plus switchbay protection and control unit is designed for connecting to non-conventional current and voltage sensors as well as to instrument transformers.

At most 8 analog input channels are available. Due to their linear characteristic, modern current and voltage sensors provide greater accuracy and reliability in signal measurements. Compared to instrument transformers, the new sensors have the following advantages:

4.8.2. Binary inputs and outputs

The REF 542plus unit acquires the primary objects status with auxiliary contacts, which are read by binary inputs, and sends commands using binary outputs. Several signals coming from other components are also monitored. Among others, the following operations are implemented using binary inputs and outputs:

- Primary objects control and interlocking in the switchgear
- Primary objects status acquisition (for example circuit breaker in opened/closed position)
- Circuit breaker spring supervision (when applicable).

Binary inputs are isolated by opto-couplers. Binary outputs can be implemented either with mechanical relays or with static (semiconductor) devices. In a switchgear with directly driven motors, static power outputs are usually required



A051256

Fig. 4.8.2.-1 Combined sensor in block type (DIN) execution

4.9. Interfacing a station automation system

An optional communication module can be provided for interfacing a station automation system. The six different protocols available for the REF 542plus make possible to interface any kind of station automation system, both from ABB or from third parties.

The following typical functions are possible:

- Primary objects status monitoring
- Primary objects control
- Protections parameterization
- Measurements, alarms end events acquisition
- Fault recorder data acquisition

6. Technical data

6.1. Analog inputs

6.1.1. Measurements

The REF 542plus unit uses the same analog inputs both for measurements and protections.

Table 6.1.1.-1 Measurements

Quantity	Class	Range
Phase current, earth current	0.5	0.1-4I_n
Line voltage, phase voltage	0.5	0.2-1.5V_n
Active, reactive energy	2	-
Active, reactive, apparent power	1	-
Cosφ	1	–1 - +1
Frequency	0.02	40-75 Hz

To achieve highest accuracy the instrument transformers or the sensors must have 0.5 percent accuracy or better in the same range.

6.1.2. Protection

Table 6.1.2.-1 Protection functions and operation time

Protection functions	Class 3
Operation time	Class 3 or minimum ±15 ms

Table 6.1.2.-2 Current and voltage transformer input values

Rated current I_n	0.2 A or 1A or 5 A
Rated voltage U_n	100 V - 125 V
Rated frequency f_n	50 Hz or 60 Hz

Table 6.1.2.-3 Thermal load capacity

Current path	250 I_n (peak value), dynamic 100 I_n for 1s, 4 I_n continuous
Voltage path	2 U_n /√3 continuous

Table 6.1.2.-4 Consumption

Current path	≤ 0.1 VA at I_n
Voltage path	≤ 0.25 VA at U_n

Table 6.1.2.-5 Current and voltage sensor input values

Voltage at rated current I_n	150 mV (rms)
Voltage at rated voltage U_n	2 V (rms)
Rated frequency f_n	50 Hz or 60 Hz

6.1.3. Analog input modules

Several different types of analog input modules are available to manage the different protection functions.

The modules are equipped with the following combinations of input current and/or voltage transformers:

- 3 or 6 current transformers for phase currents
- 3 or 6 voltage transformers for phase-to-ground or phase-to-phase voltages
- 1 or 2 current transformers for residual currents
- 1 or 2 voltage transformers for residual voltages

There are also versions for sensor inputs and mixed ones, to connect both conventional instrument transformers and sensors. At most, eight input channels are available. If programmed, input channels can be supervised.

The first three analog input channels (1-3) are designed for connecting current transformers and the next three channels (4-6) for connecting voltage transformers. The last two channels (7 and 8) are designed for measuring the residual current and residual voltage.

The power flows can still be calculated, if six current transformers, for example in case of transformer differential protection, are connected and the related line voltages of the network are connected to the last two analog input channels. The analog input channels 1 and 3 must be connected to the current transformers of NET1. The last two input channels 7 and 8 must be connected to the line voltages of NET1. If required, the power flow calculation can be done in the bus tie part of the switchgear, where six voltage transformers are connected to the analog input channels 1-6. The analog input channels 4 and 6 must be connected to the phase voltage of NET1. The last two input channels 7 and 8 must be connected to the current transformer of NET1.

6.1.4. Reaction time

In this context the protection reaction time is defined as the time elapsed between the fault detection and the closing of the contact that gives supply to the circuit-breaker tripping coil (or the equivalent tripping mechanism for magnetic drive or contactors). This time is the sum of different intervals:

1. Fault detection time
2. User defined pre set delay (for definite time protection functions)
3. Trip information processing
4. Relay output contact actuation

- At most 62 switching objects can be configured (a switching object is used to represent a primary object like a circuit breaker, a contactor and so on.)
- At most 15 energy counters can be configured.
- At most 10 analog threshold objects per analog input can be configured (analog threshold objects allow to undertake some actions depending upon the level of voltage and current, see the programming manual for more details).

LCD and HMI

- At most ten icons can be displayed on the LCD.
- At most eight switching devices icons can be displayed on the LCD.
- When binary I/O modules with mechanical relays are used, a maximum of seven switching devices can be controlled.
- At most, 40 lines can be drawn.
- At most 32 signaling LEDs organized in 4 pages can be configured.
- At most 48 control objects can be installed.
- At most 48 timer functions can be controlled.
- At most 32 command object for sequencer starting can be applied

6.4. Binary inputs and outputs

Binary input and output modules are available in two main versions: with electromechanical relays and with static outputs (power transistor types). For both of them, binary inputs are of the same type, insulated with optic couplers.

Inside a REF 542plus unit, only modules of the same type have to be present. It is not possible to have both static and electromechanical modules.

6.4.1. BIO module with mechanical output relays (version3)

Binary input and output modules type BIO3 are available in several versions.

- Voltage range low, with inputs able to withstand a voltage range from 19 ... 72 V DC. The input threshold activation level is 14 V DC.
- Voltage range high, with inputs able to withstand a voltage range from 88 ... 132 V DC. The input threshold activation level is 50 V DC.
- Voltage range high, with inputs able to withstand a voltage range from 88 ... 132 V DC. The input threshold activation level is 72 V DC.
- Voltage range high, with inputs able to withstand a voltage range from 176 ... 264 V DC. The input threshold activation level is 143 V DC.

All the above-mentioned modules can be equipped with an optional static output (power transistor) on binary output 7, instead of the normal electromechanical contact. This static output is usually needed to feed external energy meters with pulses.

4 power outputs (BO3...6)	Operating voltage	48 to 250 V DC
	Make current	120 A
	Load current	31 A
	Operating time	1 ms
2 signal outputs (BO8,9) and 1 watchdog output (WD)	Operating voltage	48 to 250 V DC
	Make current	1.5 A (100 ms)
	Ron	1.06 Ω
	Roff	40 MΩ
	Operating time	1 ms
2 coil supervision circuits on BO1 and BO2 channels	Coil OK when impendace below 10 kΩ	

6.5. Interfaces

HMI control unit

- Serial infrared (IrDa)/electrical RS-232 interface to a PC (at the front)
- Electrically isolated RS-485 standard interface to the base unit (at the rear)
- Electrical standard-interface RJ-45 for Modbus TCP and/or the embedded WEB server
- Power supply

Base unit

- Electrically isolated RS-485 standard interface to the HMI
- RS-232 standard service interface (service port for updating configuration and firmware)
- Ethernet TCP/IP port
- Power supply

0/4 ... 20 mA analog output module (optional)

- Four output channels 0 to 20 mA or 4 to 20 mA, freely configurable.

4 ... 20 mA analog input module (optional)

- Six input channels 4 ... 20 mA

Communication to a station automation system (optional)

- SPA, optical plastic fiber interface with a snap-in type connector; or glass fiber (multi-mode) with F-SMA or ST connectors
- LON (according to ABB LAG1.4), glass fiber (multi-mode) optical interface with ST connectors
- IEC 60870-5-103 with extension according to VDN guidelines for controlling, glass fiber (multi-mode) optical interface with ST connectors

- Modbus RTU/SPA bus electrical interface with two galvanically insulated SPA-bus RS-485 ports or optical interface with four standard ST connectors for glass fiber (multi-mode)
- IEC 61850 electrical interface with two RJ45 connectors or an optical interface with two LC connectors.

Ethernet Interface

- Standard RJ45 connector on the main module

CAN Open (optional and only for ABB switchgear companies).

- Open-style connector compliant with CAN Open standard and ISO11898

Input for time synchronization (optional, the supported protocol is IRIG, format B000, B002, B003).

- Glass fiber
- Wavelength: 820 nm
- Max distance: 1500 m
- Connector type: ST

6.6. Power supply

Table 6.6.-1 Base unit

Rated voltage 110 V DC	Operative range 70% to 120% of 110 V DC
Rated voltage 220 V DC	Operative range 70% to 120% of 220 V DC
Rated voltage 48 VDC to 220 V DC	Operative range 80% of 48 V DC to 120% of 220 V DC
Power consumption	≤ 20 W (Typical, 2 BIOs)
Inrush current	Module 750 168: 10 A, 1 ms; 35 A, 100 µs Module 750 126: 8.3 A, 4 ms; 21 A, 100 µs
Admissible ripple	Less than 10%

Table 6.6.-2 HMI

Rated voltage 48 V DC to 90 V DC	Operative range 85% of 48 V DC to 110% of 90 V DC
Rated voltage 110 V DC to 240 V DC	Operative range 85% of 110 V DC to 110% of 240 V DC
Power consumption	≤ 6 W backlight off and < 10W backlight on
Admissible ripple	Less than 10%

6.7. Environmental conditions

Table 6.7.-1 Environmental conditions

Ambient operation temperature	-10 + 55 °C
Ambient transport and storage temperature	-25 +70 °C
Ambient humidity	Up to 95% without condensation
Altitude	< 1.000m a.s.l

6.8. Protection degree

Base unit

- Housing: IP 20

HMI

- Front: IP 44 (IP 54 HMI version with cover)
- Rear: IP 20

HMI with cover

- Front: IP 54
- Rear: IP 20

6.9. Tests

Type test

Detailed information on type tests are listed in the document: REF 542plus. Type test certificate, 1MRS756443.

Protection functions

Protection functions are type tested according to IEC 60255 standard series.

Electromagnetic compatibility

All relevant tests are according to the following standard series:

- IEC 60255 for electromagnetic compatibility and product standard
- EN 61000 for electromagnetic compatibility
- EN 50263 for measuring relays and protection equipment
- EN 60694 + IEC 60694AMD 12000 for common specifications for high-voltage switchgear and control gears

Insulation resistance

Greater than >100 MΩ at 500 V DC.

7. Ordering

The different variants have their own specific order numbers that identify the type designation for the desired hardware and software combination.

The type code designation can be seen in Fig. 7.-1:

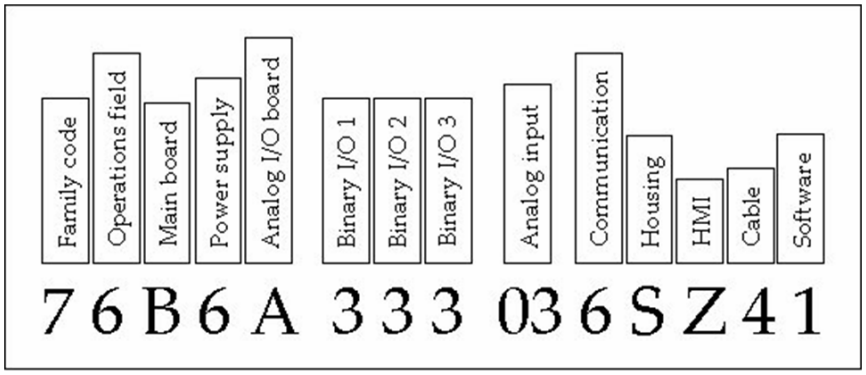


Fig. 7.-1 Type code designation for ordering REF 542plus

Each code is dedicated to a specific application or module. The description for each type code is listed in the following tables. The codes mentioned below are mostly used for the operations field of REF 542plus. The codes are slightly different in DNV and ATEX. Because ATEX certification is only valid for a specific version of REF 542plus, it is required to obtain a new certification after each release. The release 1.1 of ATEX certified units is REF 542plus with version V4C02, release 2.0 with version V4D02 and release 2.5 with version V4E04. For releases 1.1 and 2.0 the REF 542plus unit is delivered with the previous HMI V4 and for release 2.5 with the new HMI V5. Order the DNV certifies for marine application. Note that the DNV version can only deliver with the previous HMI V4.

7 6 B 6 A 3 3 3 0 3 6 S Z 4 1

Table 7.-1 Family code

NUMBER	CODE	NAME	DESCRIPTION
7		REF 542plus	Product family for the feeder terminal unit REF 542plus

7 6 B 6 A 3 3 3 0 3 6 S Z 4 1

Table 7.-2 Application areas

NUMBER	CODE	NAME	DESCRIPTION
6		REF 542plus	Normal operation
A		REF 542plus DNV	Marine and offshore application
B		REF 542plus ATEX-1	Protection of motor in an explosive area (Release 1.1)
D		REF 542plus ATEX-2	Protection of motor in an explosive area (Release 2.0)
F		REF542plus ATEX-2.5	Protection of motor in an explosive area (Release 2.5)

7 6 B 6 A 3 3 3 0 3 6 S Z 4 1

Table 7.-3 Mainboard versions

NUMBER	CODE	NAME	DESCRIPTION
B	751021/ 802	Basic	Version with RJ 45 Ethernet port
S	751021/ 803	Standard	Version basic with additional IRIG B and CAN interface
F	751021/ 801	Full	Version standard with additional optical links
A	014629/ 802	Basic	Version with RJ 45 Ethernet port
E	014629/ 803	Standard	Version basic with additional IRIG B and CAN interface
C	014629/ 801	Full	Version standard with additional optical links

7 6 B 6 A 3 3 3 0 3 6 S Z 4 1

Table 7.-4 Power supply versions

NUMBER	CODE	NAME	DESCRIPTION
1	750126/801	U_n = 110 V DC	Operative range 70% to 120% of 110 V DC
2	750126/802	U_n = 220 V DC	Operative range 70% to 120% of 220 V DC
3	750168/801	U_n = 48 - 220 V DC	Operative range 80% of 48 V DC to 120% of 220 V DC
6	750168/802	U_n = 48 - 220 V DC	Marine application with operative range 80% of 48 V DC to 120% of 220 V DC

7 6 B 6 A 3 3 3 0 3 6 S Z 4 1

Table 7.-5 Analog I/O modules

NUMBER	CODE	NAME	DESCRIPTION
N	none	No analog input or output	Empty analog I/O module slot
A	750211/801	Analog input module 4-20 mA	Analog input module for 4-20 mA installed, up to 6 inputs
B	750237/801	Analog output module 0 (4)-20 mA	Analog output module for 0(4)-20 mA installed, up to 4 outputs

7 6 B 6 A 3 3 3 0 3 6 S Z 4 1

Table 7.-6 Binary I/O modules

NUMBER	CODE	NAME	DESCRIPTION
1	701952/801	Static I/O	Application in GIS panel with coil supervision through a control continuity check
2	701952/802	Static I/O - without control continuity check	Static I/O without control continuity check
5	750132/801	Binary I/O3 - 19-72 V/14 V DC, standard	Standard version with a 14 V DC threshold value for an application in an auxiliary circuit with a DC voltage range of 19-72 V DC
6	750132/803	Binary I/O3 - 19-72 V/14 V DC, with static channel	As no. 5 + one static output channel for energy metering
7	750161/801	Binary I/O3 - 19-72 V/14 V DC, interconnected input, standard	As no. 5 + interconnected binary inputs
8	750161/803	Binary I/O3 - 19-72 V/14 V DC, interconnected input, with static channel	As no. 5 + interconnected binary inputs + one static output channel for energy metering
9	750132/802	Binary I/O3 - 88-132 V/ 50 V DC, standard	Standard version with a 50V DC threshold value for an application in an auxiliary circuit with a DC voltage range of 88-132 V DC
A	750132/804	Binary I/O3 - 88-132 V/ 50 V DC, with static channel	As no. 9 + one static output channel for energy metering
B	750161/802	Binary I/O3 - 88-132 V/ 50 V DC, interconnected input, standard	As no. 9 + interconnected binary inputs
C	750161/804	Binary I/O3 - 88-132 V/ 50 V DC, interconnected input, with static channel	As no. 9 + interconnected binary inputs + one static output channel for energy metering
D	750132/805	Binary I/O3 - 88-132 V/ 72 V DC, standard	Standard version with a 72 V DC threshold value for an application in an auxiliary circuit with a DC voltage range of 88-132 V DC

NUMBER	CODE	NAME	DESCRIPTION
E	750132/806	Binary I/O3 - 88-132 V/ 72 V DC, with static channel	As no. D + one static output channel for energy metering
F	750132/807	Binary I/O3 - 176-264 V/ 143 V DC, standard	Standard version with a 143 V DC threshold value for an application in an auxiliary circuit with a DC voltage range of 176-264 V DC
G	750132/808	Binary I/O3 - 176-264 V/ 143 V DC, with static channel	As no. F + one static output channel for energy metering

Static I/O: 14 inputs, 7 power outputs, 2 signal outputs and 1 watchdog output.

BIO 3: 14 inputs, 6 power outputs, 2 signal outputs and 1 watchdog output.

7 6 B 6 A 3 3 3 03 6 S Z 4 1

Binary IO Slot 2: Version of binary I/O. Possible selection depends on the selected version of the binary I/O 1. If no binary I/O is needed, the slot can remain empty. The corresponding code can be taken from Table 7.-6.

7 6 B 6 A 3 3 3 03 6 S Z 4 1

Binary IO Slot 3: Version of binary I/O. Possible selection depends on the selected version of the binary I/O 1. If no binary I/O is needed, the slot can remain empty. The corresponding code can be taken from Table 7.-6.

7 6 B 6 A 3 3 3 03 6 S Z 4 1

Analog Input XX: There are three different types of analog input versions which can be selected, as shown in the following tables:

Table 7.-7 Sensors

NUMBER	CODE	DESCRIPTION
01	750138/803	Analog Input sensors version

Table 7.-8 Mix of sensors and transformers

NUMBER	CODE	DESCRIPTION
10	750170/843	3 sensors + 3 sensors + 1 CT/0.2 A + 1 VT
11	750170/846	3 sensors + 3 VT + 1 CT/0.2 A + 1 VT
12	750170/847	3 sensors + 3 sensors + 1 CT
13	750170/851	3 sensors + 3 sensors + 1 CT + 1 VT
14	750170/852	3 sensors + 3 sensors + 1 CT/0.2 A
15	750170/853	3 sensors + 3 sensors + 1 VT + 1 VT

NUMBER	CODE	DESCRIPTION
16	750170/854	3 sensors + 3 CT + 1 CT/0.2 A + 1 VT
17	750170/855	3 sensors + 3 CT + 1 CT/0.2 A + 1 CT/0.2 A

Table 7.-9 Mix of transformers

NUMBER	CODE	DESCRIPTION
30	750170/804	3 CT + 3 VT + 1 CT/0.2 A + 1 VT
31	750170/806	3 VT + 3 VT + 1 CT/0.2 A + 1 CT/0.2 A
32	750170/807	3 CT + 3 CT
33	750170/809	3 CT + 3 CT + 1 CT/0.2 A + 1 VT
34	750170/812	3 VT + 3 VT + 1 VT
35	750170/817	3 CT + 3 VT + 1 CT
36	750170/819	3 CT + 3 VT + 1 CT + 1 VT
37	750170/821	3 CT + 0 VT + 1 CT
38	750170/822	3 CT + 0 VT + 1 CT/0.2 A
39	750170/825	3 CT + 3 VT + 1 CT/0.2 A + 1 CT/0.2 A
40	750170/826	3 CT + 3 VT + 1 VT + 1 VT
41	750170/827	3 CT + 3 CT + 1 CT + 1 CT
42	750170/828	3 CT + 3 CT + 1 CT + 1 VT
43	750170/824	3 CT + 3 VT + 1 CT + 1 CT

7 6 B 6 A 3 3 3 03 6 S Z 4 1

Table 7.-10 Communication (with optional communication module)

NUMBER	CODE	NAME	DESCRIPTION
E	1VCR009634001	IEC 61850/MODBUS TCP with RJ45	
F	1VCR009634002	IEC 61850/MODBUS TCP with LC optical connector	
N	none	Without communication	No communication is requested
1	750079/801	Modbus RTU / SPA RS 485	
2	750079/802	Modbus RTU / SPA glass fibre with ST connectors	
3	701842/801	SPA plastic fibre	
4	701842/802	SPA glass fibre with SMA connectors	
5	701842/803	SPA glass fibre with ST connectors	
6	750071/801	LON - LAG 1.4	
7	750071/803	IEC 60870-5-103	

7 6 B 6 A 3 3 3 03 6 S Z 4 1

Table 7.-11 Enclosure versions

NUMBER	CODE	NAME	DESCRIPTION
S	750154/801	Normal base unit	Normal version
W	750102/801	Wide base unit	Wide version

7 6 B 6 A 3 3 3 03 6 S Z 4 1

Table 7.-12 HMI variations

NUMBER	CODE	NAME	DESCRIPTION
N	none	No HMI	
A	007346/003	HMI V5 - IEC, auxiliary voltage 48-90 V DC	
B	007346/004	HMI V5 - IEC, auxiliary voltage 110-240 V DC	
C	007346/007	HMI V5 - IEC, external cover, auxiliary voltage 48-90 V DC	
D	007346/008	HMI V5 - IEC, external cover, auxiliary voltage 110-240 V DC	
E	007346/011	HMI V5 - IEC, Chinese, auxiliary voltage 48-90 V DC	
F	007346/012	HMI V5 - IEC, Chinese, auxiliary voltage 110-240 V DC	
G	007346/015	HMI V5 - IEC, Chinese, external cover, auxiliary voltage 48-90 V DC	
H	007346/016	HMI V5 - IEC, Chinese, external cover, auxiliary voltage 110-240 V DC	

7 6 B 6 A 3 3 3 03 6 S Z 4 1

Table 7.-13 Connection cables between the HMI and the base unit[1)]

NUMBER	CODE	NAME	DESCRIPTION
N	none	No cable	No cable
1	750142/801	HMI cable - 1.8 m	1.8 m cable with corresponding connectors
2	750142/817	HMI cable - 2.5 m	2.5 m cable with corresponding connectors
3	750142/818	HMI cable - 3.5 m	3.5 m cable with corresponding connectors
4	750142/819	HMI cable - 4.5 m	4.5 m cable with corresponding connectors

Table 7.-14 Software licenses[1)]

NUMBER	CODE	NAME	DESCRIPTION
1	1MRS090002	Software base license	Software level : Base
2	1MRS090003	Software high license	Software level : High
3	1MRS090004	Software basic low license	Software level : Basic Low
4	1MRS090005	Software basic license	Software level : Basic
5	1MRS090006	Software multi low license	Software level : Multi Low
6	1MRS090007	Software multi license	Software level : Multi
7	1MRS090008	Software differential license	Software level : Differential
8	1MRS090009	Software distance license	Software level : Distance

[1)]A limitation of the protection functionality with a software license. Contact your local ABB organization for more detailed information. The software level Base can only be ordered by ABB switchgear companies. It is of the same level as the software level Distance.

Table 7.-15 SW tool licenses

Code	Description
1MRS 151022	REF 542plus Operating Tool CD
1MRS 151062	REF 542plus Configuration Tool CD

Use the key in Fig. 7.-2 to generate the type designation. The code numbers in the example are not complete and should be taken from the corresponding tables above.