Third Generation of active arc fault protection system

For low voltage switchgear assemblies

Powering Business Worldwide

Contents

Introduction

ARCON® 3G – General outline

According to American National Fire Protection Association (NFPA), Arc Fault is a "dangerous condition associated with the release of energy caused by an electrical arc" as part of an Arc Fault, a type of electrical explosion or discharge that results from a low-impedance connection through air to ground or another voltage phase in electrical system.

Arc fault errors are the most powerful faults, which can occur in electrical installations. Although serious precautionary measures that are given due consideration and implemented in advance, these faults happen. They can be caused by a multitude of factors, such as aging of the insulation, environmental conditions as well as operating errors (human faults) or by animals entering in electrical switchboard. Electric arcs can cause heavy damage to switchgear and present a serious hazard to operating personnel, including heavily injures and death. In order to prevent this, the most suitable solution is to foreseen arc fault protection systems inside electrical cabinets. These units detect the light and increasing current of an emerging arc fault and send a trip signal to the shunt trip of an upstream protection device such as a circuit breaker.

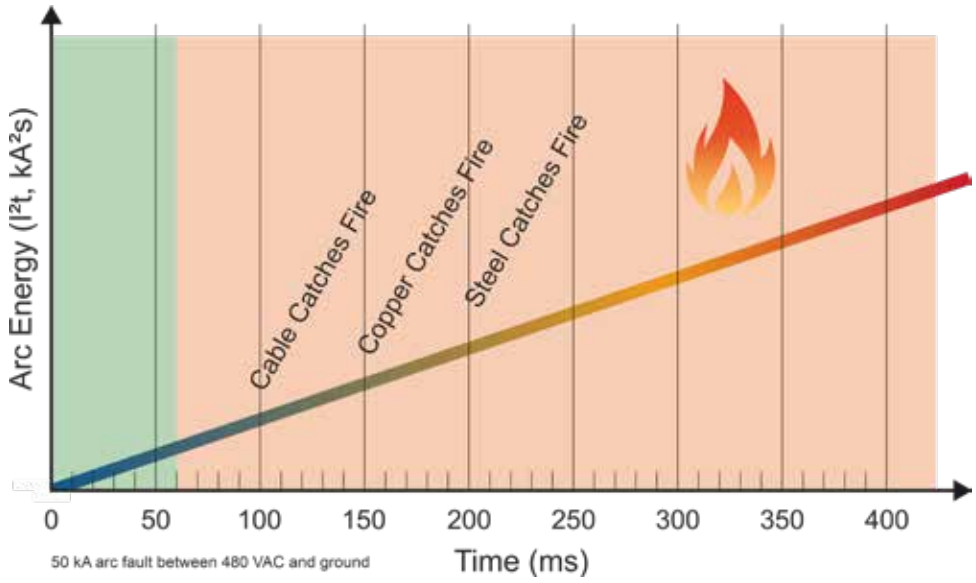


Figure 1.1 ARC faults errors damage curve

A conventional protection device is not able to clear the fault within a few milliseconds and to prevent destruction of operating devices. This is where the arc protection system establishes the connection between a short detection time and a fast response time.

ARCON 3G presents effective modular and compact system for arc protection in low voltage switchgear assemblies, which successfully provides both, personnel and assembly protection. ARCON 3G detects an electrical arc caused by a short circuit through optical sensors and the load current input on the system to employ the fast clearance of arc faults on an electrical system with a total arc mitigation time less than 2 ms.

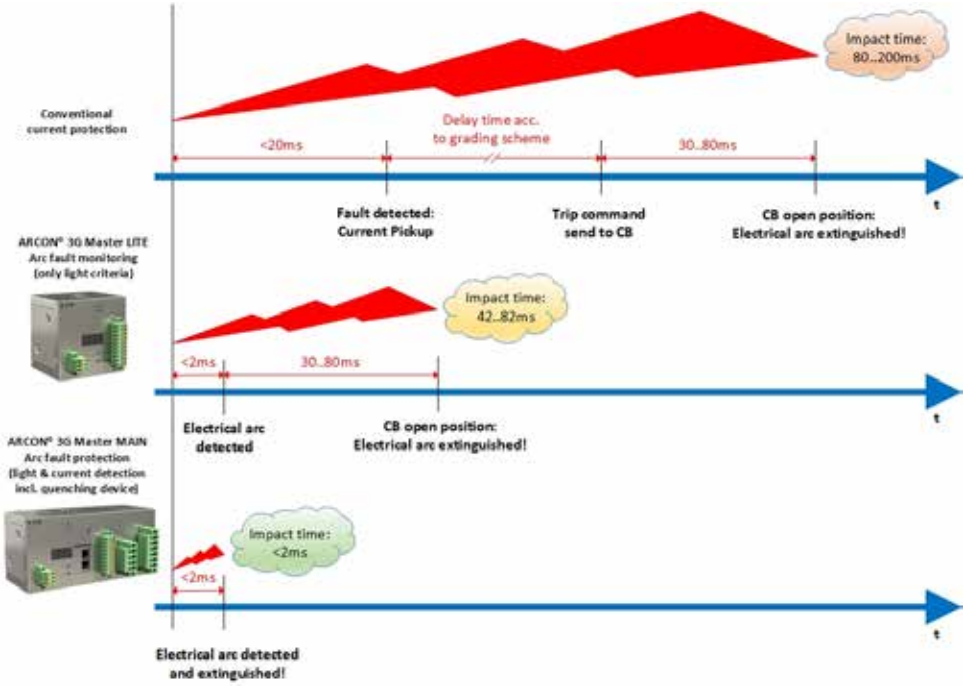


Figure 1.2 Comparison of impact timing for systems with and without ARC protection

Functional scope

The ARCON 3G protection system is designed as modular system, so that flexible use in different switchgears is ensured.

The ARCON 3G system provides following modules which can be used to establish different protection levels and topologies:

ARC-LITE-3G	Master LITE unit providing trip and watchdog contacts and communication link to connected modules.
ARC-MAIN-3G	Master MAIN unit providing current measurement for additional tripping criteria, voltage measurement, trip and watchdog contact and communication link to connected modules, HMI and Masterlink.
ARC-TMOD-1QD	Tripping module to operate separate quenching device (ARC-AT).
ARC-DMOD-3SL	Module for electrical arc detection via line sensor (ARC-SL).
ARC-DMOD-6NTFS *)	Module for electrical arc detetion via point sensor (ARC-NTFS).
ARC-MAIN-HMI	Human Machine Interface to display and control the Master MAIN.

ARCON 3G offers three different systems (levels) of arc fault protection:

1. ARCON 3G simple arc protection system (only light criteria for arc fault monitoring)
2. ARCON 3G extended arc protection system (light & current criteria for full personnel and assembly protection)
3. ARCON 3G complex arc protection system (up to 8 extended systems communicating over Masterlink)

*) requires firmware version 5 or even higher!

Note: especially for retrofit business, all devices have to operate on the same firmware version!

ARCON 3G simple arc protection system

The ARCON 3G simple arc protection system is based on the following modules:

- ARC-LITE-3G Master LITE unit providing trip contacts & communication link to connected Line Sensor(s).
- ARC-DMOD-3SL up to 3 Line Sensors (ARC-SL) and 1 Mobile Light Sensor (ARC-NTFS-MLS)
- ARC-DMOD-6NTFS up to 6 Point Sensors (ARC-NTFS-3M/ARC-NTFS-6M) and 1 Mobile Light Sensor (ARC-NTFS-MLS) for detecting electrical arc per each module.

Master LITE unit provides 3 parallel operating fast binary tripping outputs, trip alarm and watchdog binary outputs and 3 x 15-segment display for indication of system status / error codes. Master LITE unit doesn't require any programming or parameter setting. All module housings are made of stainless and DIN rail TS35 mounting.

Note: Up to 31 Detection modules can be interlinked to the master module via internal CANBUS communication and maximum distance between the master module and the last connected module is 100m.

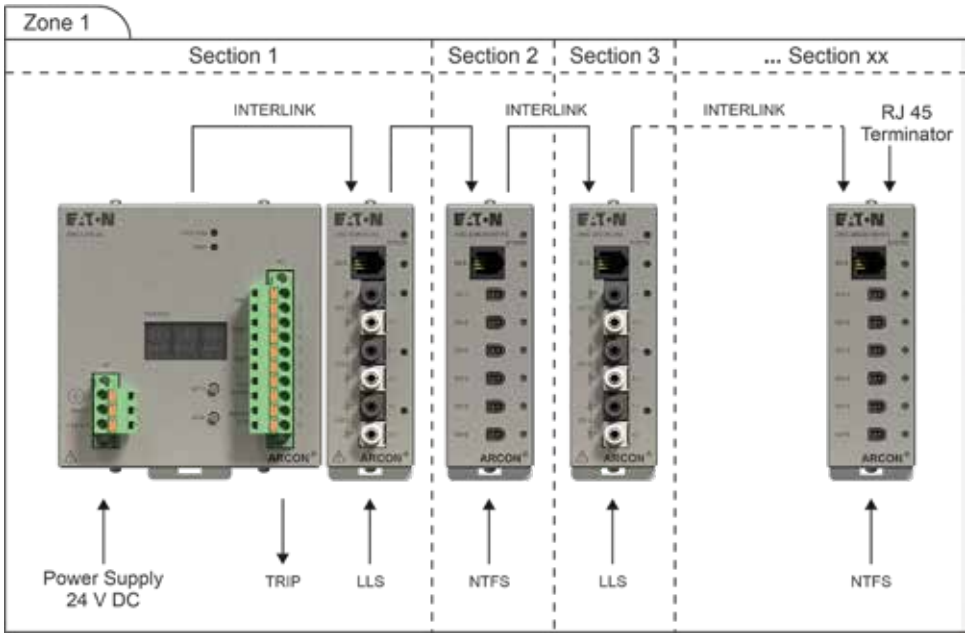


Figure 1.3 ARCON 3G simple arc protection system

ARCON 3G extended arc protection system

The ARCON 3G extended arc protection system is based on the following modules:

- ARC-MAIN-3G Master MAIN unit providing current measurement for additional tripping criteria (di/dt), voltage measurement, HMI, trip contacts & communication link to connected modules
- ARC-DMOD-3SL up to 3 Line Sensors (ARC-SL) and 1 Mobile Light Sensor (ARC-NTFS-MLS)
- ARC-DMOD-6NTFS up to 6 Point Sensors (ARC-NTFS-3M/ARC-NTFS-6M) and 1 Mobile Light Sensor (ARC-NTFS-MLS) for detecting electrical arc per each module.
- ARC-MAIN-HMI Human Machine Interface to display and control the Master MAIN
- ARC-TMOD-1QD Tripping module for external quenching device (ARC-AT)

Master MAIN unit provides 3 parallel operating fast binary tripping outputs, trip alarm and watchdog binary outputs and 3 x 15-segment display for indication of system status / error codes. Master MAIN requires programming and parameter setting via separate software (APPT) for initial setup. All module housings are made of stainless and DIN rail TS35 mounting. (except HMI)

ARCON 3G extended arc protection system can be easily implemented in different applications by parameter setting. ARC-MAIN-3G module has possibility to take current rate of change (di/dt) as additional tripping criteria. Measuring values (U/I/P…etc.) are displayed on HMI unit.

On top of that Master MAIN is able to trip external quenching device (ARC-AT) via IGNITION PORT over Tripping module.

Note: Up to 31 Detection modules can be interlinked to the master module via internal CANBUS communication and maximum distance between the master module and the last connected module is 100m.

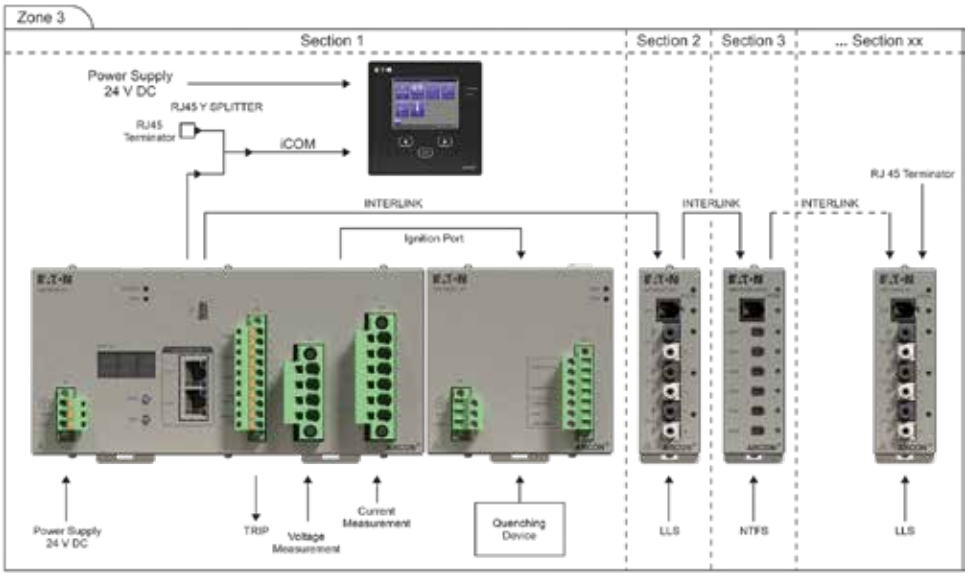


Figure 1.4 ARCON 3G extended arc protection system

ARCON 3G complex arc protection system

The ARCON 3G complex arc protection system can link up to 8 extended systems together with MASTERLINK connection. With ARCON 3G complex arc protection system it is possible to provide line or ring topology for the purpose of redundancy. Main purpose of MASTERLINK is to share current criteria between master units.

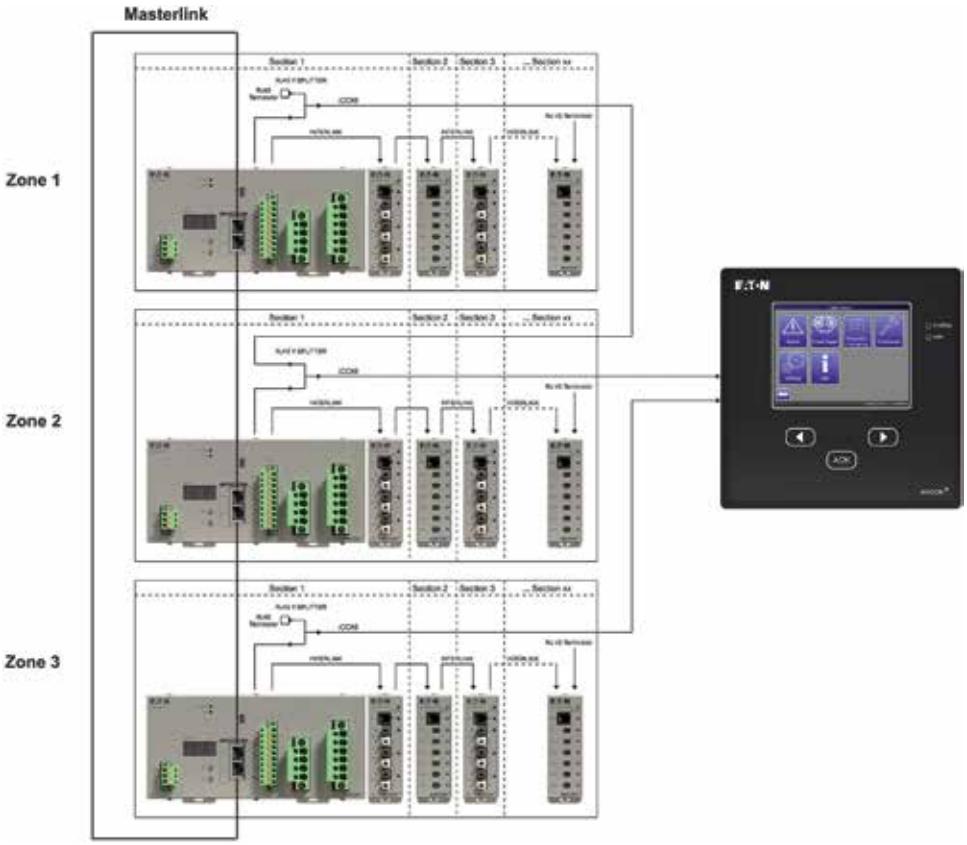


Figure 1.5 ARCON 3G complex arc protection system

Terminal connections

ARC-LITE-3G – Master LITE (arc fault monitoring)

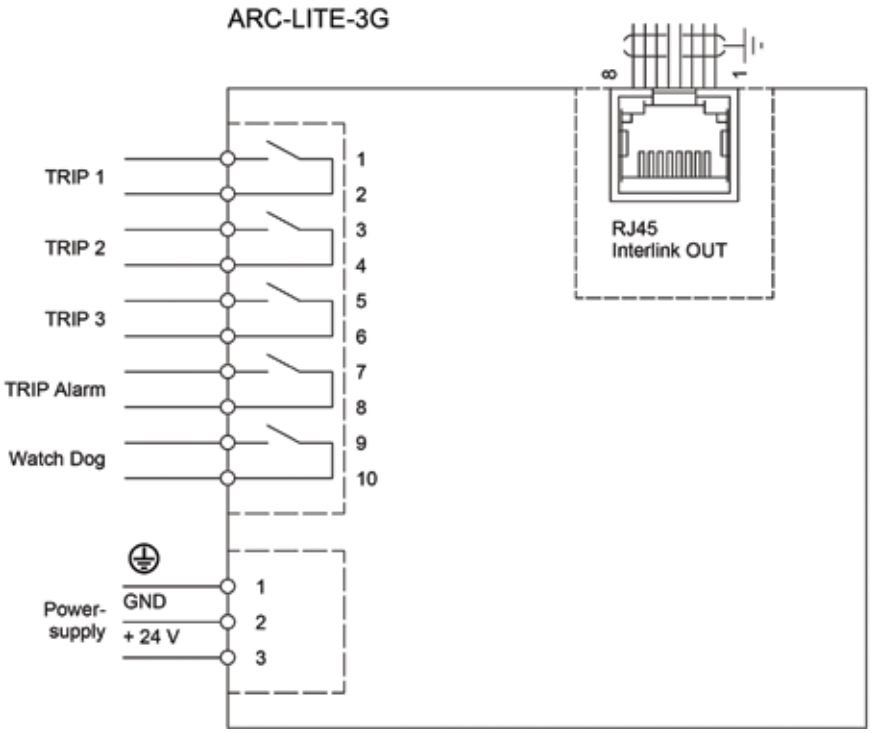


Figure 1.6 Connection diagram ARC-LITE-3G

ARC-MAIN-3G – Master MAIN (arc fault protection)

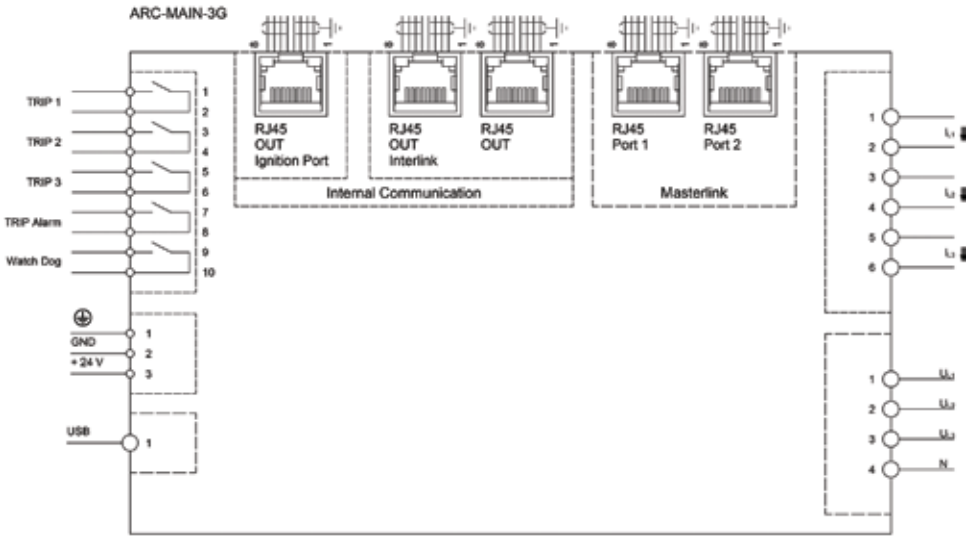


Figure 1.7 Connection diagram ARC-MAIN-3G

ARC-DMOD-3SL – Detection module (up to 3 Line Sensors + 1 MLS)

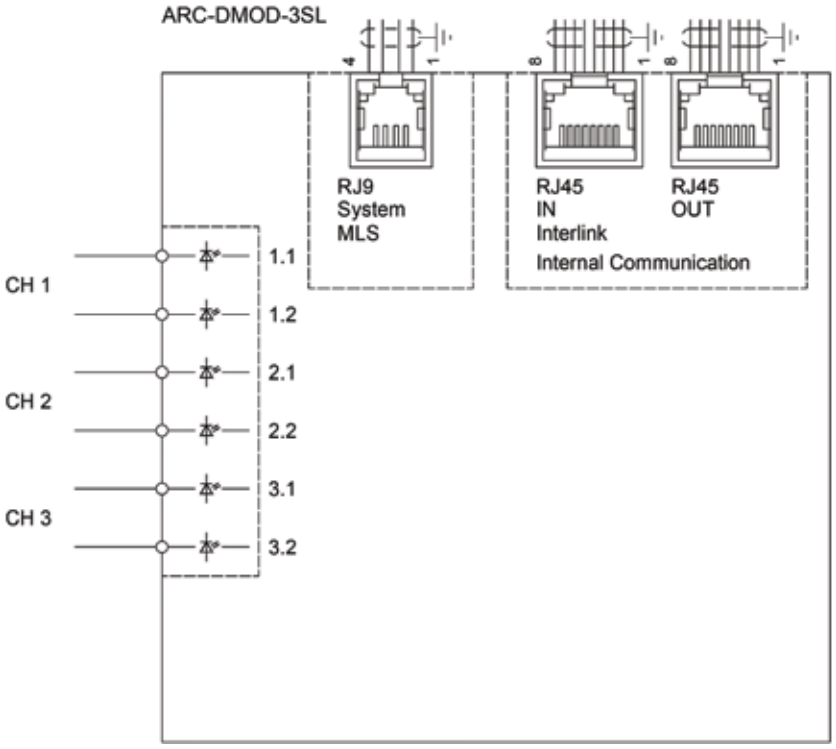


Figure 1.8 Connection diagram ARC-DMOD-3SL

ARC-DMOD-6NTFS - Detection module (up to 6 Point Sensors + 1 MLS)

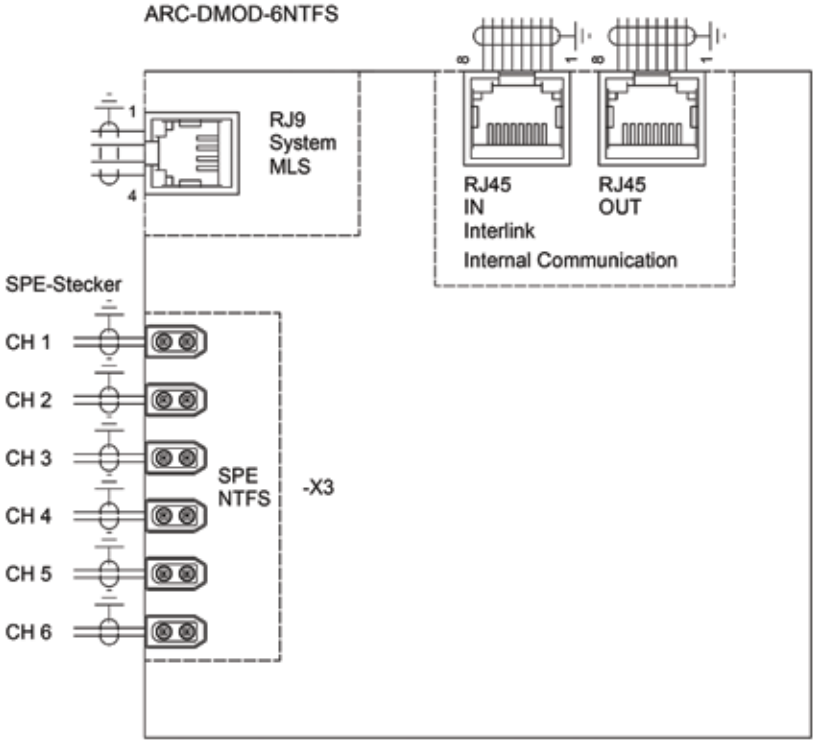


Figure 1.8.1 Connection diagram ARC-DMOD-6NTFS

ARC-MAIN-HMI – External display and control unit (HMI)

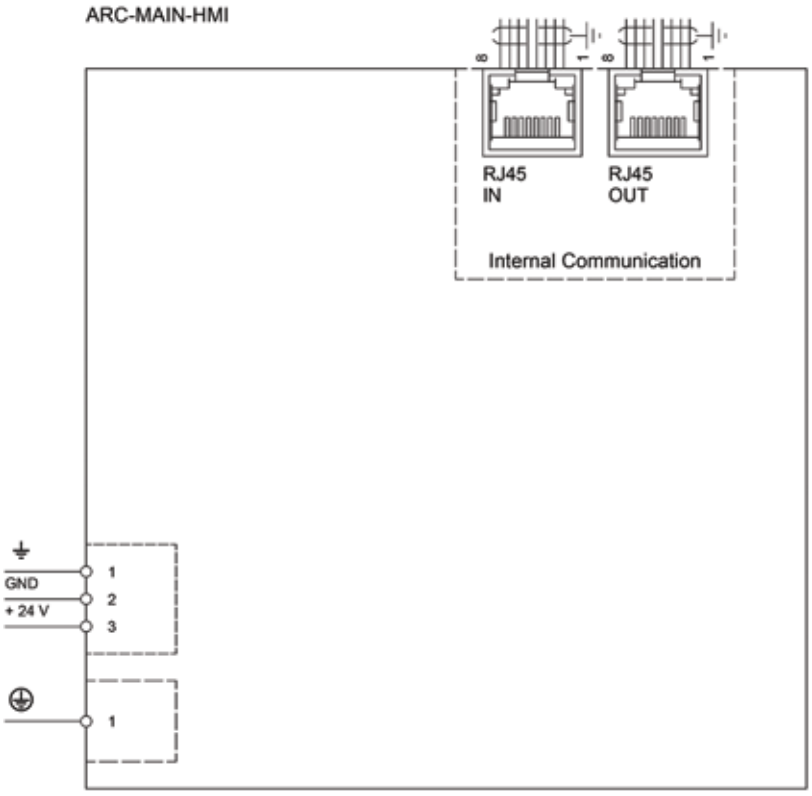


Figure 1.9 Connection diagram ARC-MAIN-HMI

ARC-TMOD-1QD – Tripping module (ignition command for quenching device)

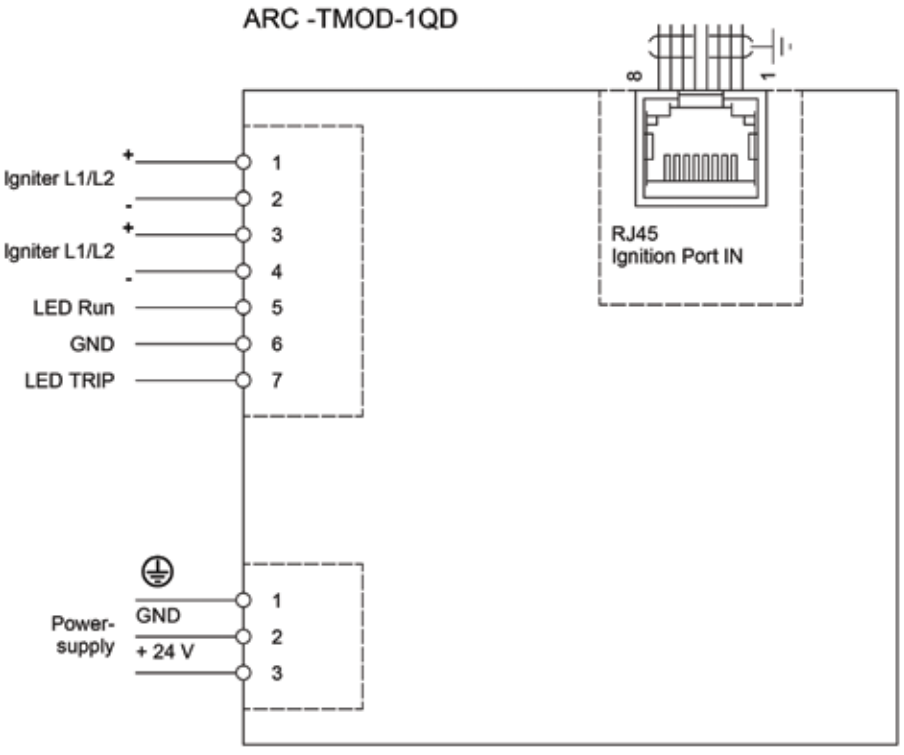


Figure 1.10 Connection diagram ARC-TMOD-1QD

Mounting instruction

DIN Rail modules

All ARCON 3G modules are designed for DIN rail TS35 mounting to ensure quick and easy installation. For installation in a switchgear cabinet safety distance to adjacent components and cabinet parts like internal shrouding, door and side panel is required.

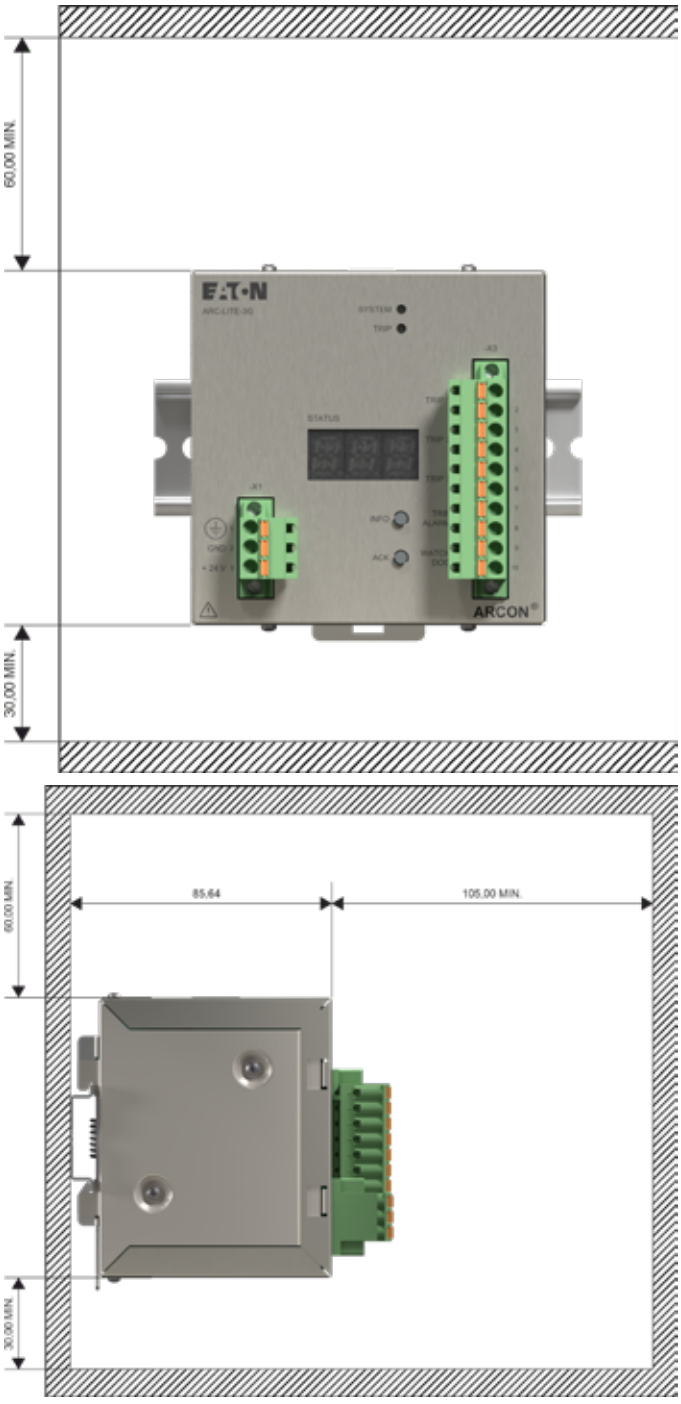


Figure 1.11 DIN rail installation instructions

Note: Solid connection through uncoated and non-insulated DIN-rail profile to the earthing concept of the enclosure. (no additional cable connection for protective earthing required)

ARC-MAIN-HMI

Before connecting and start-up the ARC-MAIN-HMI unit, it is necessary to install the device into a housing or switchgear cabinet.

The following mounting instruction describes the installation of the ARC-MAIN-HMI device as an example!

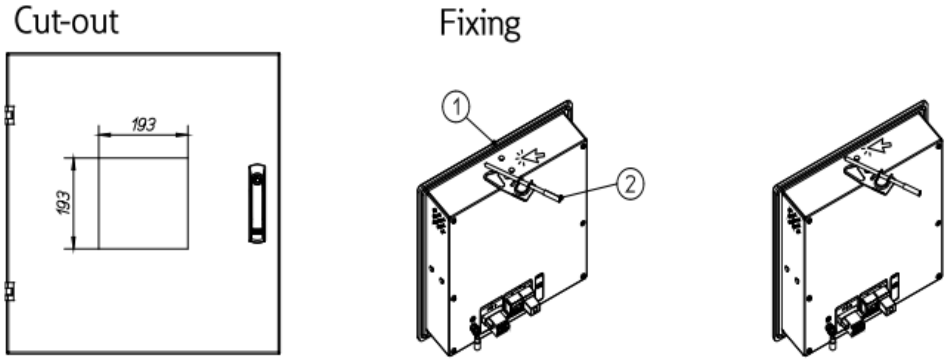
Figure 1.12 Display and Control unit (HMI)

First, it is necessary to prepare a cut-out in the door panel of the dedicated compartment. The only restriction regarding this is the size of the existing installation surface. This may not fall below the overall dimensions of the ARC-MAIN-HMI device.

For keeping the device position in the cut-out, employ a slight counter-pressure to the front plate of the device and look to the backside. Each side of the housing provides two bolt heads for installation of the fixing clamps.

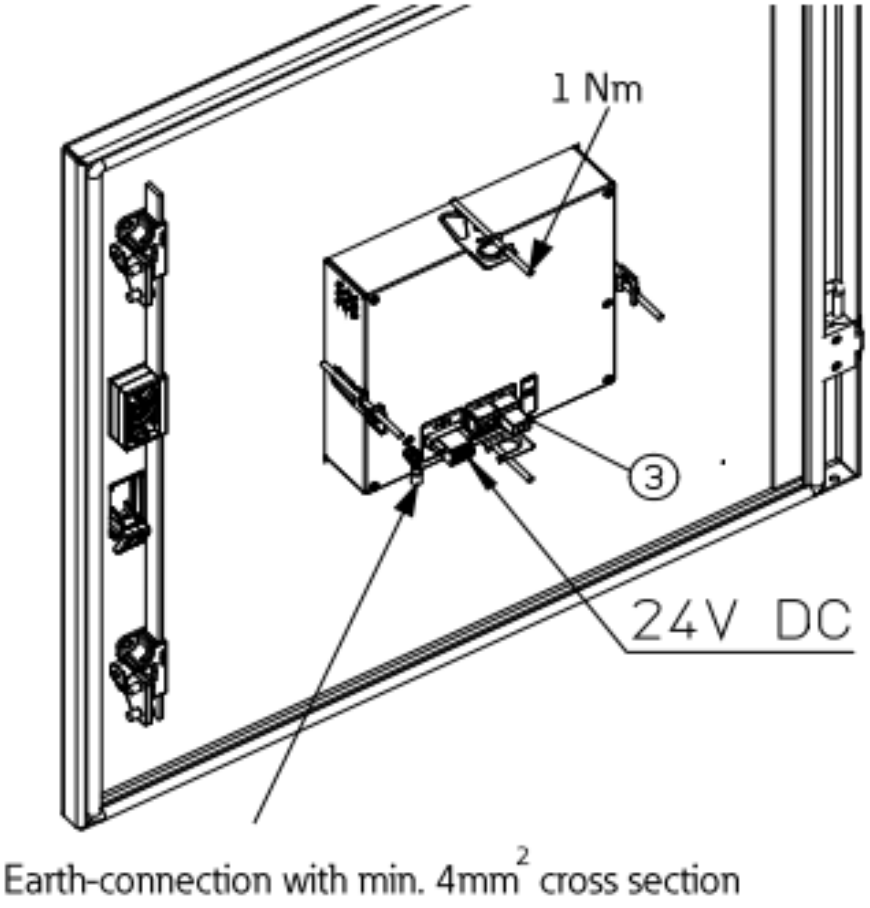
Insertion of the device into the panel cut-out shall be conducted with a slight offset for vertical and horizontal direction. To bring the head of the bolts into the cut-out one after the other please push the device alternatingly into the cut-out in the following order: right, top, left and bottom until the seal is evenly seated on the installation surface (door panel).

While holding the ARC-MAIN-HMI device, click one fixing clamp to the bolt head which is next to the rear of the housing.



Now, turn the fixing clamp to the second bolt head with slight pressure. Hearing a click indicates the correct installation.

Thereafter, install the remaining three fixing clamps on the other sides of the housing. Now the four fastened fixing clamps can be tightened by using a screwdriver.



Note: Unmounting or changing the ARC-MAIN-HMI device can be done in reverse order.

Simple system with ARC-LITE-3G Master

The Simple system constellation contains of one Master LITE and up to 31 Detection modules connected via INTERLINK communication. One detection module supports up to 3 Line Sensors (ARC-SL) or up to 6 Point Sensors (ARC-NTFS) and 1 MLS sensor (ARC-NTFS-MLS).

The Simple system supports an easy configuration process without any programming or parameter setting.

Features:

- Stainless steel housing
- Easy mounting on DIN rail TS35
- Up to 31 light detection modules can be connected to the Master LITE via INTERLINK communication
- Up to 100m of INTERLINK distance between the Master LITE and the last connected light detection module
- Up to 93 Line Sensors (ARC-SL) or up to 186 Point Sensors (ARC-NTFS)
- Up to 31 Mobile Light Sensors ARC-NTFS-MLS for enhanced personnel protection
- 3x 15-segment display
- 3 parallel operating fast binary tripping outputs (NO) with ≤ 2 ms tripping time
- 1 binary trip alarm output (NO) for indication
- 1 binary Watch Dog output (NC) for system supervision
- No parameter setting required

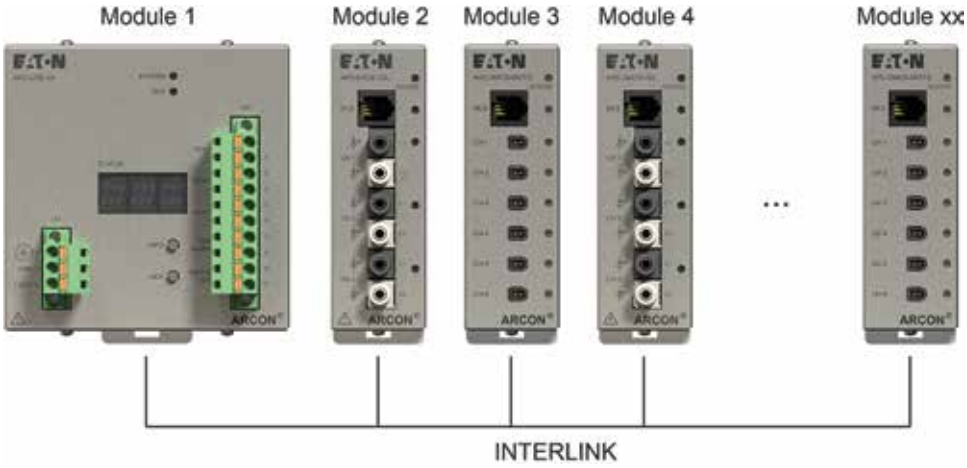


Figure 2.1 Simple system – Block diagram

Components

Description	Picture
Master LITE (ARC-LITE-3G)	
Detection modules (ARC-DMOD-3SL)	
(ARC-DMOD-6NTFS)	
Nuisance Tripping Free Sensors (ARC-NTFS-MLS)	
Intelligent Point Sensor (ARC-NTFS-3M / ARC-NTFS-6M)	
Fiber Optic Line Sensor (ARC-SL)	

Table 2.1: Simple system – Components

Constellation

The Simple system constellation consists of one Master LITE and at least 1 up to 31 Detection modules depending on project requirements. The example of Simple system constellation is shown on the following picture:

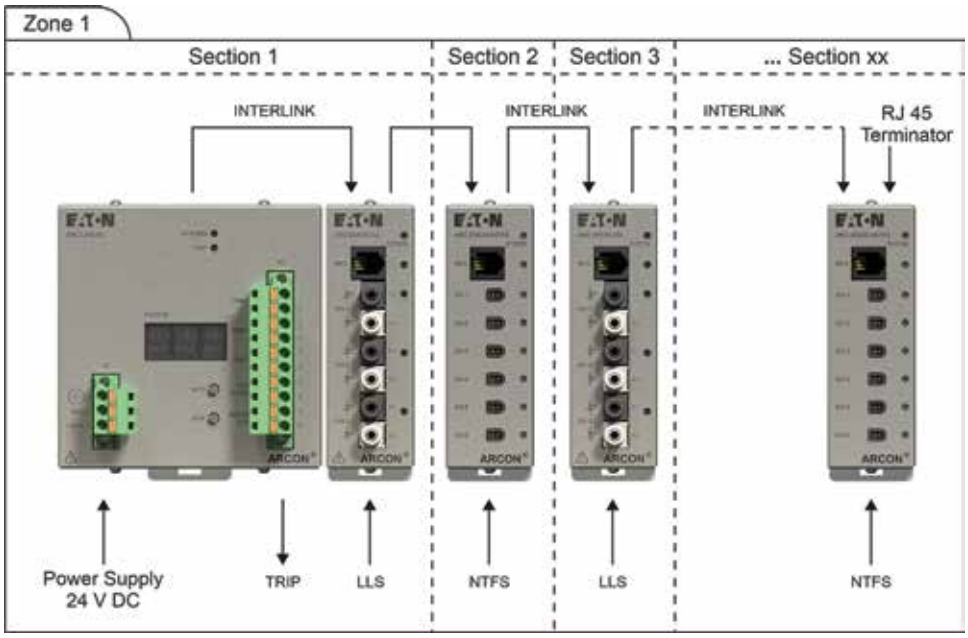


Figure 2.2 Simple system – Constellation

INTERLINK must be connected properly, otherwise devices can get damaged!

Master LITE

The Simple system consists of one ARC-LITE-3G and multiple number of ARC-DMOD-3SL / ARC-DMOD-6NTFS.

The Master LITE has five different areas:

1. Power connector
2. LEDs
3. Internal HMI
4. Binary Outputs
5. Communication interface

Power connector

The power connector is used to power the entire Simple system topology, master itself and all connected Detection modules via INTERLINK (RJ45 connector on the top side).

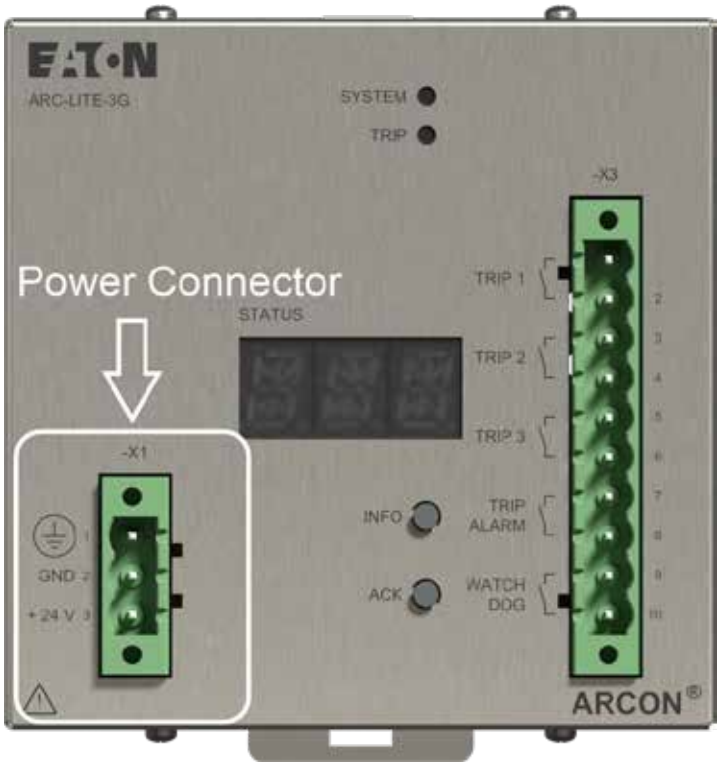


Figure 2.3 Master LITE – Power connector

LEDs

The Master LITE has two LEDs on the front plate:

- SYSTEM
- TRIP

More details regarding the LEDs operating are available in chapter "2.7 Events & Alarms"

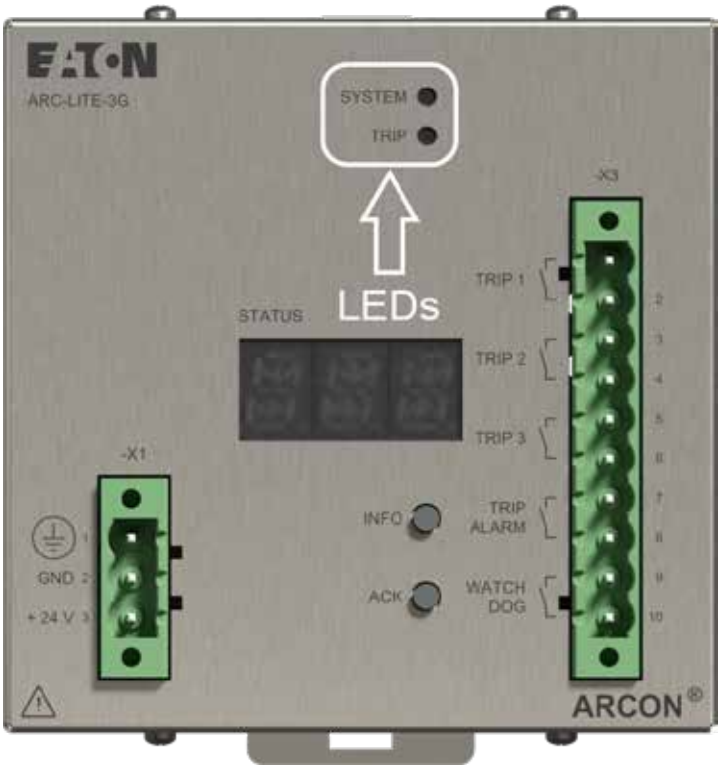


Figure 2.4 Master LITE – LEDs

Internal HMI

Master LITE has an ordinary HMI, which could be used for configuration and status indication.

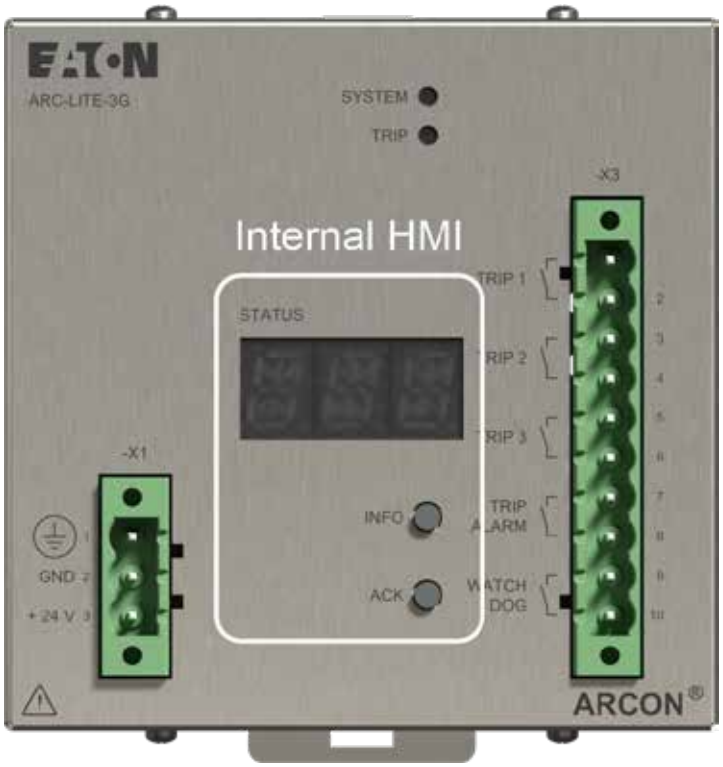


Figure 2.5 Master LITE – Internal HMI

HMI during configuration process

At the end of the configuration process the user has to acknowledge the shown information about number of detected modules and sensors as it is described in the chapter "2.5 Configuration process".

HMI for status indication

At the start of normal operation mode, the display is turned off and it stays off until system error or trip event occurs. Also, if all system errors and trips are acknowledged the display is turned off.

There are two types of events which require acknowledgment in the normal operation mode:

- System error
- TRIP

System error

More than one system error may occur in the system. All system errors will be written in the Event logger and each of them must be acknowledged by user in chronological order.

Error codes are presented as **E.XX**[1] If user presses and holds INFO button following additional information are alternately shown at intervals of 2 seconds:

- Affected module **M.XX**[2]
- Affected sensor **S.XX**[3]

When user releases INFO button the error code is shown again. User can acknowledge the displayed system error by pressing ACK button.

TRIP

Trip is presented by event **"T.13".** The TRIP event is written in the Event logger and must be acknowledged by user. If user presses and holds INFO button following additional information are alternately shown at intervals of 2 seconds:

Affected module **M.XX**[2]

Affected sensor **S.XX**[3]

ACK ALL alarms

To acknowledge all active alarms in the list, using only one command over internal HMI, follow the next steps:

- Press and hold the ACK button.
- After 2s the segment display will show text: "ACK".
- Then release the ACK button and all possible alarms will be acknowledged.

Note: An alarm can be acknowledged only if its source is already deactivated.

[1] XX = EVENT NUMBER
[2] XX = MODULE ADDRESS
[3] XX = SENSOR NUMBER

Binary outputs

The Master LITE, as well as Simple system, has following binary outputs:

- 3x fast (≤ 2 ms) TRIP 1 / 2 / 3 outputs
- 1x TRIP ALARM output
- 1x WATCHDOG (WD) output

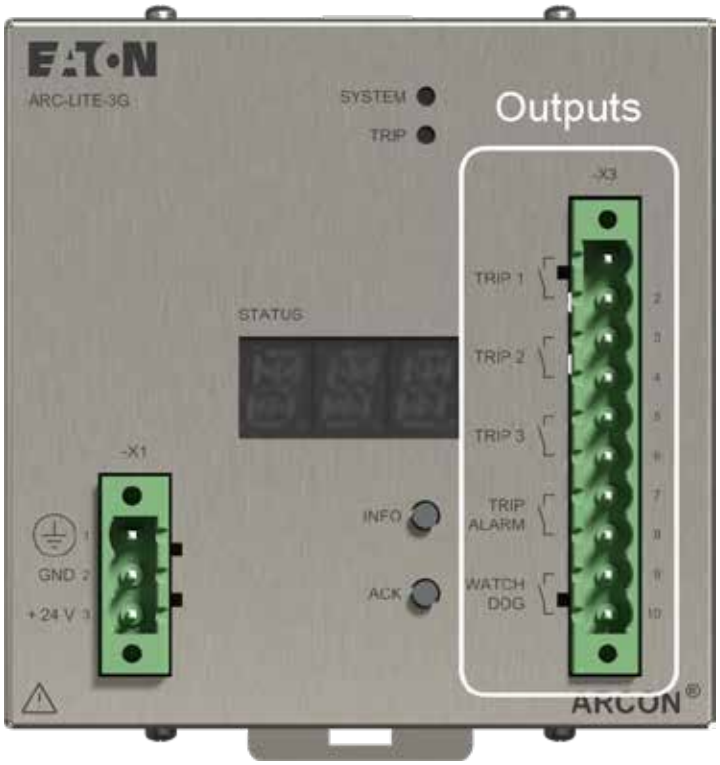


Figure 2.6 Master LITE – Binary Outputs (BO)

Fast TRIP outputs

All TRIP 1, TRIP 2 and TRIP 3 outputs (NO) are activated immediately after a trip event "T.13" has been detected. The system response time, measured from real Arc fault occurs to the activated TRIP outputs, is less than 2 ms.

TRIP ALARM output

The TRIP ALARM output (NO) is also activated immediately after a trip event "T.13" has been detected.

WATCHDOG output

The WD output is working as normally closed contact (NC) and will become active (open contact) if an system error alarm "E.xx" (xx = event number) is detected or the power supply is off (please see chapter 2.7 Events & Alarms).

Communication interface

INTERLINK connector is located on the top of Master LITE unit. Up to 31 light detection modules can be connected to the Master LITE via INTERLINK communication. The max. distance between the Master LITE and the last connected module is 100m.

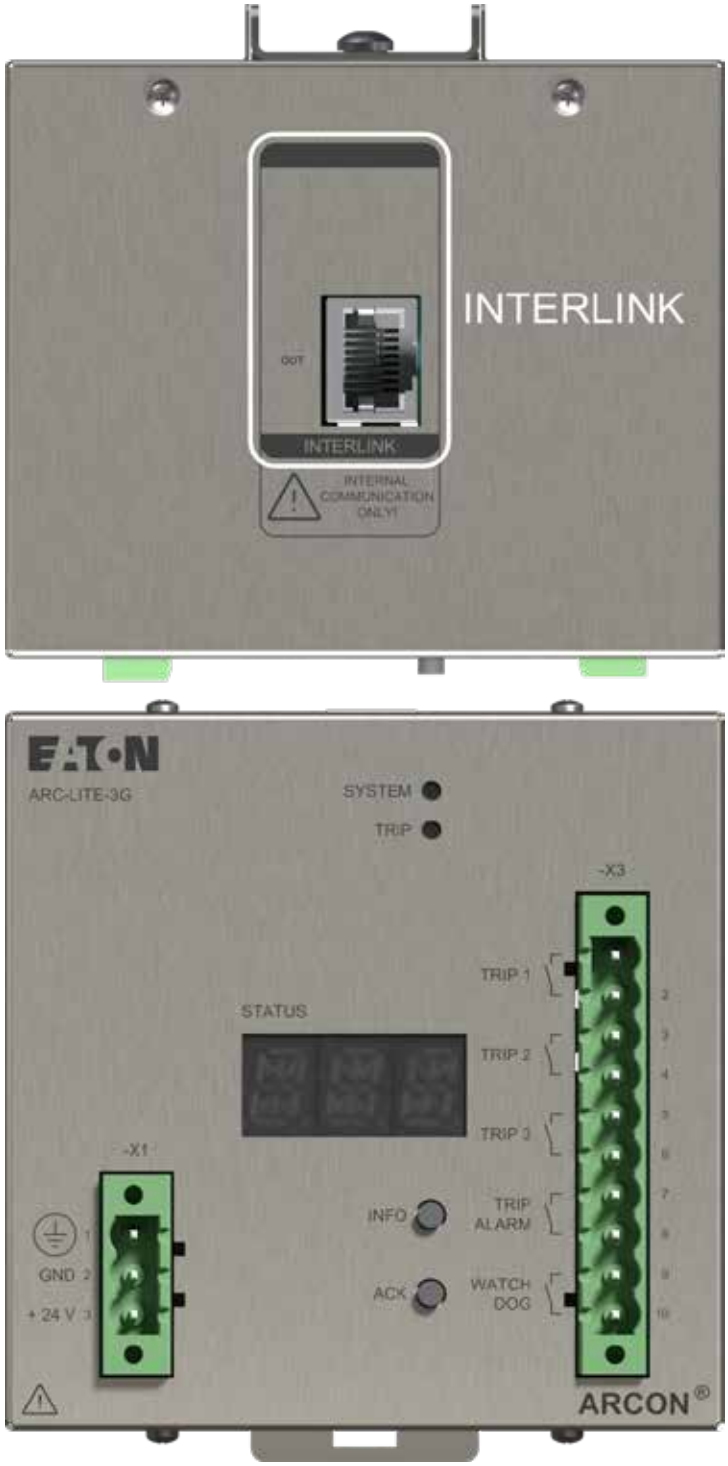


Figure 2.7 Master LITE – Communication interface

Detection modules

Detection module is connected via INTERLINK connection to master module.

The Detection module supports up to three Line Sensors (ARC-SL), six Point Sensors (ARC-NTFS) and one Mobile Light Sensor (ARC-NTFS-MLS).

Figure 2.8 Simple system – Detection module

For the case that sensors are enabled by parameter LEDs have following states:

SYSTEM LED:

- **Orange** Not in operation
- **Red** System alarm
- **Green** In operation
- **Off** De-energized

SENSOR LED:

- **Orange** Wire fault / Short-circuit (only NTFS-sensor)
- **Red** Trip
- **Green** In operation
- **Off** Deactivated

Configuration process

The configuration process is an automated process of parameterization which includes only using of internal HMI (segment display and buttons). To start configuration process, follow the next steps:

1. Master LITE has to be de-energized.
2. Connect all modules and sensors which you want to use.
3. Press and hold the "ACK" button on the master module during powering up.
4. Release the button when you see that system LED blinking orange.
5. Acknowledge (by pressing the ACK button) detected number of:
   a. L.xx (xx = Number of detected modules)
   b. S.xx (xx = Number of detected sensors)

After acknowledging of detected modules and sensors by user, the Master LITE will create and store the configuration file in non-volatile memory and it will restart. After auto-restart, it will initialize constellation stored in the configuration file.

The configuration file will be permanently saved in non-volatile memory.

If the constellation should be changed, the configuration process must be performed again.

Note: The system doesn't support any hot-plugging function!

Normal operation mode

After initialization process, the system enters normal operation mode.

In the normal operation mode, the master executes two parallel tasks:

1. System supervision
2. Arc detection

System supervision

In normal operation mode the master executes a cyclic self-check and the presence of all configured modules. If an error is detected an appropriate system error event will be activated and watchdog relay will be activated. For details see list of "2.7 Events & Alarms". Acknowledgment of system error is possible only if error source is deactivated. After acknowledging of all detected system errors, the watchdog relay output will be deactivated again.

Arc detection

The second main task in normal operation mode is waiting for notification of arc detection. If a module detects light the master will activate the trip and alarm relay outputs.

The trip must be acknowledged by using internal HMI interface. After acknowledging the relay outputs will be deactivated again.

Events & alarms

The Master LITE checks its peripherals and flags of all modules connected on the INTERLINK. If an error or trip flag is encountered, then the according event will be set. Furthermore, the on-board watchdog is monitoring the system constantly.

Alarms are events which require user acknowledgment (ACK is "YES" in table below). An alarm disappears only if it is acknowledged and the trigger condition is false. The alarms are saved non-volatile, so in case of loss of supply voltage the active alarms are not lost. After return of supply voltage all previous active alarms will be restored. If TRIP alarm is restored, then the output relays will be activated again. For details about the impact of events on Master LITE LEDs, relays and LED display codes please see table below.

Prefix	Number	Text	ACK	Relay TRIP 1-3	Relay Trip alarm	Relay Watchdog	LED System	LED TRIP
	1	RESTART	NO	OPEN	OPEN	OPEN	OFF	OFF
	2	START CONFIGURATION	NO	-	-	-	Orange / 1Hz	-
	3	START ADDRESSING	NO	-	-	-	-	-
E	4	ADDRESSING ERROR	YES	-	-	OPEN	Red / 2Hz	-
	5	ADDRESSING OK	NO	-	-	-	-	-
E	6	FLASH ACCESS ERROR	YES	-	-	OPEN	Red / 2Hz	-
	7	CONFIGURATION FINISHED	NO	-	-	-	-	-
	8	START INITIALIZATION	NO	-	-	OPEN	Orange / 2Hz	-
E	9	PARAMETERIZATION ERROR	YES	-	-	OPEN	Red / 2Hz	-
	10	PARAMETERIZATION OK	NO	-	-	-	-	-
	11	INITIALIZATION FINISHED	NO	-	-	-	-	-
	12	START NORMAL OPERATION MODE	NO	-	-	CLOSED	Green / 1Hz	-
T	13	TRIP	YES	CLOSED	CLOSED	-	Green / 1Hz	Red
E	14	WD RESET	YES	-	-	OPEN	Red / 2Hz	-
E	15	ADC ERROR	YES	-	-	OPEN	Red / 2Hz	-
E	16	DAC ERROR	YES	-	-	OPEN	Red / 2Hz	-
E	17	PARAMETER ERROR	YES	-	-	OPEN	Red / 2Hz	-
E	18	SENSOR WIRE FAULT	YES	-	-	OPEN	Red / 2Hz	-
E	19	SENSOR CONSTELLATION ERROR	YES	-	-	OPEN	Red / 2Hz	-
E	20	INTERLINK ERROR	YES	-	-	OPEN	Red / 2Hz	-
E	21	INTERLINK CONSTELLATION ERROR	YES	-	-	OPEN	Red / 2Hz	-
E	22	INTERLINK COMPATIBILITY ERROR	YES	-	-	OPEN	Red / 2Hz	-
E	23	CONFIGURATION MISSING	YES	-	-	OPEN	Red / 2Hz	-
E	47	FAULTY LIGHT DETECTION	YES	-	-	OPEN	Red / 2Hz	-
E	48	OVERHEAT	YES	-	-	OPEN	Red / 2Hz	-
E	53	ALARM LIST OVERFLOW	YES	-	-	OPEN	Red / 2Hz	-
E	55	SENSOR SHORT CIRCUIT	YES	-	-	OPEN	Red / 2Hz	-

Table 2.2: Simple system – Events & Alarms

Troubleshooting alarms

Alarm	Text	Trigger	Solution
E.04	Addressing error	INTERLINK	Check if all INTERLINK cables are connected properly and the RJ45 terminator on the last module has been placed on OUT. Restart the system and try to acknowledge the alarm.
E.06	Flash access error	Internal hardware of master module	Restart the system and try to acknowledge the alarm. If not possible please contact the manufacturer.
E.09	Parameterization error	INTERLINK	Check if all INTERLINK cables are connected properly, restart the system and try to acknowledge the alarm. Tip: Do not disconnect any INTERLINK cable while initialization process (SYSTEM LED blinking orange), because it can produce this alarm.
E.14	WD reset	Internal hardware of master module or a connected module	Restart the system and try to acknowledge the alarm. If not possible please contact the manufacturer.
E.15	ADC error	Internal hardware of master module or a connected module	Restart the system and try to acknowledge the alarm. If not possible please contact the manufacturer.
E.16	DAC error	Internal hardware of master module or a connected module	Restart the system and try to acknowledge the alarm. If not possible please contact the manufacturer.
E.17	Parameter error	INTERLINK	Check if all INTERLINK cables are connected properly, restart the system and try to acknowledge the alarm.
E.18	Sensor wire fault	ARC-DMOD-3SL module (CH1-3) A sensor wire fault will be detected when configured sensor is disconnected more than 5s. It can be also detected in case when sensor is damaged, broken or wrong type.	Check if the sensor is connected properly and try to acknowledge the alarm. In this case the sensor must be replaced with a new one and the alarm can be acknowledged.
E.19	Sensor constellation error	ARC-DMOD-3SL module (CH1-3) Unexpected sensor has been detected. Sensor is connected on a position where it should not be connected. Position: M.xx – xx = module number S.yy – yy = sensor number	Disconnect the issued sensor and try to acknowledge the alarm.
E.20	INTERLINK error	INTERLINK communication interface	Check if all INTERLINK cables are connected properly and the RJ45 terminator on the last module has been placed on OUT. Restart the system and try to acknowledge the alarm.
E.21	INTERLINK constellation error	INTERLINK module missing or unexpected module detected. Wrong module type. Example: Point sensor module is connected instead of line sensor.	Check if all INTERLINK cables are connected properly and the number/type of parameterized modules is correct. Exchange the wrong device type or disconnect the added module, restart the system and try to acknowledge the alarm.
E.22	INTERLINK compatibility error	INTERLINK version of a module is not compatible with version supported by master.	Replace the module with compatible firmware version.
E.23	Configuration missing	Software Master LITE unit Configuration file missing or corrupted. Also, it will be detected on each new produced Master LITE which is not yet configured.	Perform the configuration process: -Power down Master LITE -Press and hold ACK button -Power up Master LITE -Acknowledge number of detected modules and sensors The configuration file will be stored and system will restart. Then try to acknowledge the alarm.
E.47	Faulty light detection	ARC-DMOD-3SL module (CH1-3) Too long light detection (>10s).	Ensure that no external light source is interferring the system (e.g. Direct sunlight).
E.48	Overheat	Master module overheat. The internal temperature is too high.	Check if the module environment is according to the specification. When everthing is in line try to acknowledge the alarm.
E.53	Alarm list overflow	Master module There is no more space for alarms in the Alarm list. Info: The alarm list can store up to 100 alarms.	All active alarms must be acknowledged and then it will be possible to acknowledge alarm “E.53”.
E.55	Sensor short circuit	It will be detected in case when sensor is damaged or broken.	Check if the sensor is properly connected and try to acknowledge the alarm. If it repeats, the sensor has to be replaced with the correct one and the alarm can be acknowledged.

Table 2.3: Simple system – Troubleshooting alarm

Extended system with ARC-MAIN-3G Master

Features:

- Stainless steel housing
- Easy mounting on DIN rail TS35
- Up to 31 light detection modules can be connected to the Master MAIN via INTERLINK communication
- Up to 100m of INTERLINK distance between the Master MAIN and the last connected light detection module
- Up to 93 Line Sensors (ARC-SL) or up to 186 Point Sensors (ARC-NTFS)
- Up to 31 Mobile Light Sensors ARC-NTFS-MLS for enhanced personnel protection
- 3 x 15-segment display (internal HMI)
- 3 parallel operating fast binary tripping outputs (NO) with ≤ 2 ms tripping time
- 1 binary trip alarm output (NO) for indication
- 1 binary Watch Dog output (NC) for system supervision
- Current criteria I>> (di/dt) as additional tripping criteria
- Arc Protection Parameter Tool (APPT) allows easy system configuration and adaptation to each individual application
- Measurement (Current, Voltage, Power, Frequency etc.)
- Optional connection of ARC-TMOD-1QD to trip external quenching device (ARC-AT)
- Optional connection of ARC-MAIN-HMI for user-friendly display and control interface
- Optional MASTERLINK communication between up to 8 Extended systems

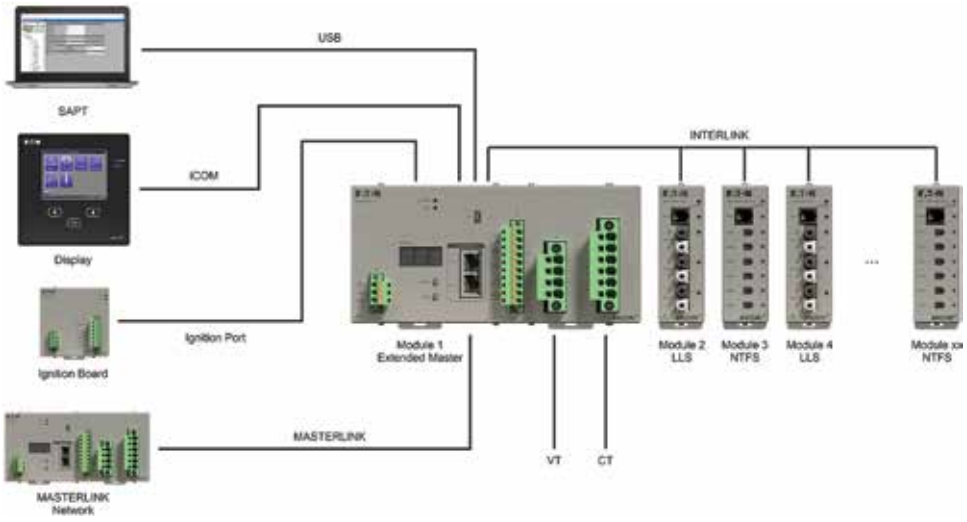


Figure 3.1 Extended system – Block diagram

Components

Description	Picture
Master MAIN (ARC-MAIN-3G)	
Detection modules (ARC-DMOD-3SL)	
(ARC-DMOD-6NTFS)	
Display (ARC-MAIN-HMI)	
Tripping module (ARC-TMOD-1QD)	

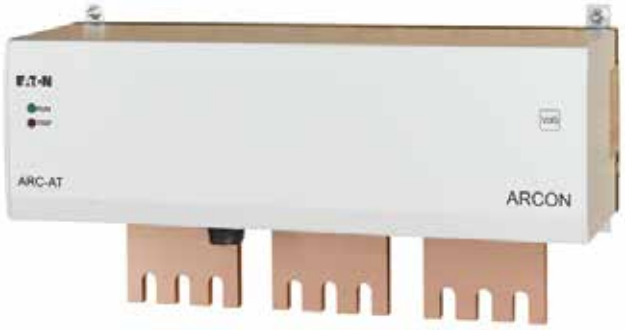
Description	Picture
Arc Quenching Device (ARC-AT)	
Nuisance Tripping Free Sensors (ARC-NTFS-MLS) Intelligent Point Sensor (ARC-NTFS-3M / ARC-NTFS-6M)	
Fiber Optic Line Sensor (ARC-SL)	

Table 3.1: Extended system – Component

Constellation

The Extended system constellation consists of one Master MAIN and depending on the project requirements…

- Up to 31 light detection modules, connected over INTERLINK connection.
- One display (external HMI) unit, connected over iCOM connection.
- One Tripping module connected over the IGNITION PORT.
- Connection to the APPT parameter tool (on the PC), over USB configuration port.
- Measurement of current and voltage.
- Optional MASTERLINK communication between up to 8 Extended systems.

The example of Extended system constellation is shown on the following picture:

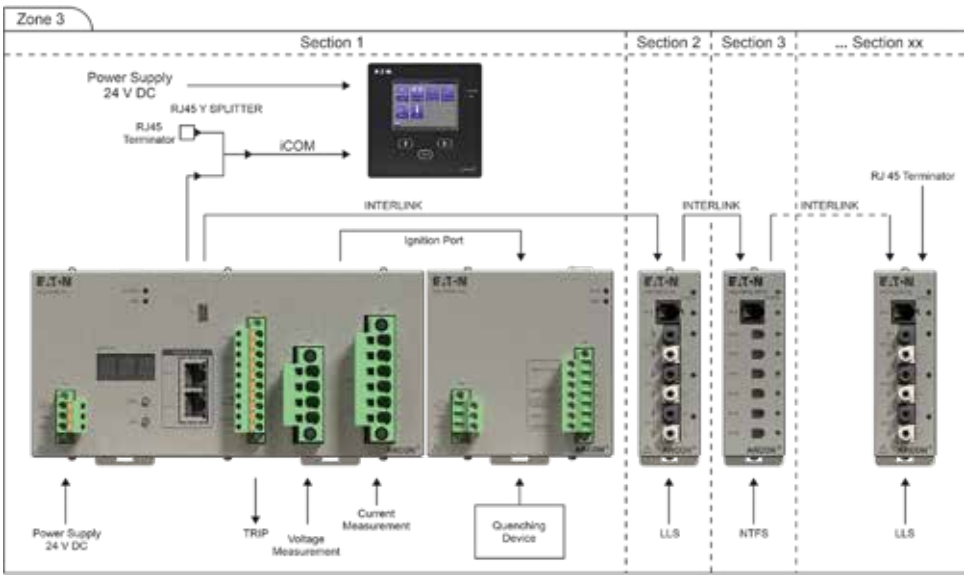


Figure 3.2 Extended system – Constellation

INTERLINK must be connected properly, otherwise devices can get damaged!

Master MAIN

The Extended system consists of one ARC-MAIN-3G and multiple number of ARC modules. With the Complex System up to 8 Extended systems can be connected via the MASTERLINK interface.

The Master MAIN has six different areas:

1. Power connector
2. LEDs
3. HMI
4. Binary Outputs
5. Measurements
6. Communication interfaces

Power connector

The power connector is used to power the Master MAIN itself and all connected modules on the INTERLINK (RJ45 connector on the top side).

Figure 3.3 Master MAIN – Power connector

LEDs

The Master MAIN has two LEDs on the front plate where the status can be verified easily:

- SYSTEM
- TRIP

More details regarding the LEDs operating can be found within the chapter "3.11 Events & Alarms"

Figure 3.4 Master MAIN – LEDs

HMI

Master MAIN supports 2 types of HMI:

- Internal HMI -> 3x15 segments display and two buttons INFO and ACK
- External HMI -> touchscreen display on ARC-MAIN-HMI

Internal HMI

The Master MAIN has a simple HMI which can be used in normal operation mode.

At the start of normal operation mode, the display is turned off and it stays off until a system error or trip event occurs. After acknowledging all system errors, the display will turn off again.There are two types of events which require acknowledgment in the normal operation mode:

- SYSTEM
- TRIP

Figure 3.5 Master MAIN – Internal HMI

System error

More than one system error may occur in the system. All system errors will be written in the Event logger and each of them must be acknowledged by user in chronological order.Error codes are presented as E.XX[6] . If user presses and holds INFO button following additional information are alternately shown at intervals of 2 seconds:

- Affected module M.XX[7]
- Affected sensor S.XX[8]

When user releases INFO button the error code is shown again. User can acknowledge the displayed system error by pressing ACK button.

TRIP

Trip is presented by event **"T.13".** The TRIP event is written in the Event logger and must be acknowledged by user. If user presses and holds INFO button following additional information are alternately shown at intervals of 2 seconds:

- Affected module M.XX[7]
- Affected sensor S.XX[8]

When user releases INFO button the trip code is shown again. User can acknowledge the displayed trip by pressing ACK button.

[6] XX = EVENT NUMBER
[7] XX = MODULE ADDRESS
[8] XX = SENSOR NUMBER

ACK ALL alarms

To acknowledge all active alarms in the list, using only one command over internal HMI, follow the next steps:

- Press and hold the ACK button.
- After 2s the segment display will show text: "ACK".
- Then release the ACK button and all possible alarms will be acknowledged.

Note: An alarm can be acknowledged only if its source is already deactivated.

External HMI

Master MAIN supports one external ARC-MAIN-HMI unit connected over iCOM interface (please see "3.7 Display / External HMI").

Binary outputs

The Master MAIN, as well as Extended system, has following binary outputs:

- 3x fast (≤ 2 ms) TRIP 1 / 2 / 3 outputs
- 1x TRIP ALARM output
- 1x WATCHDOG (WD) output

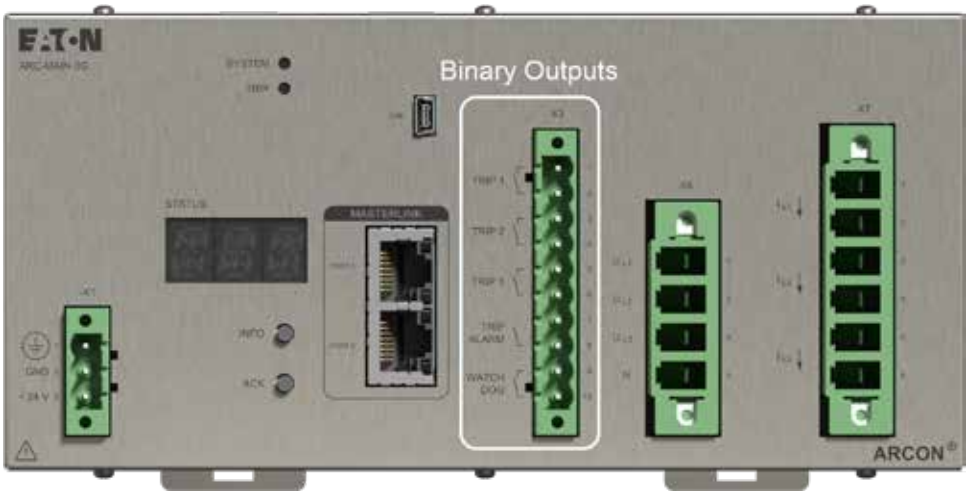


Figure 3.6 Master MAIN – Binary Outputs (BO)

Fast TRIP outputs

All TRIP 1, TRIP 2 and TRIP 3 outputs (NO) are activated immediately after a trip event "T.13" has been detected. The system response time, measured from real Arc fault occurs to the activated TRIP outputs, is less than 2 ms.

TRIP ALARM output

The TRIP ALARM output (NO) is also activated immediately after a trip event "T.13" has been detected.

WATCHDOG output

The WD output is working as normally closed contact (NC) and will become active (open contact) if an system error alarm "E.xx" (xx = event number) is detected or the power supply is off (please see chapter 3.11 Events & Alarms).

Measurements

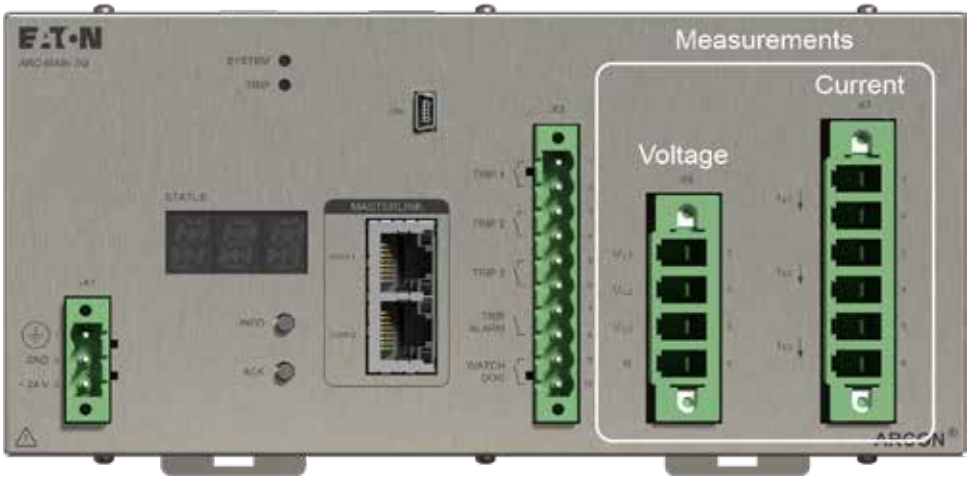


Figure 3.7 Master MAIN – Measurements

The Master MAIN supports measurement of:

- Current
- Voltage / Frequency
- Power (Active, Reactive and Apparent)

Current

The main purpose of 3-phase current measurement is to use current criteria in the arc detection. There is current criteria which could be used in the arc detection:

- I>> (di/dt)

The display unit will show the measured current values:

- IL1
- IL2
- IL3

The measuring accuracy of a current transformer measurement is ensured if the nominal power (load) of the selected current transformer is not exceeded by system-specific factors such as cable length, cable cross-section, overcurrent factor (current criterion di / dt), etc. The CT is operated correctly between the full nominal power (load) e.g. 10 VA and the 1/4 load (2.5 VA). If the pick-up level for overcurrent detection is set to a value greater than 2.5, the selection of protection transformers must be taken into account, as otherwise the measuring transformer can go into saturation.

Note: Note: When using CTs with secondary level of 1A, up to 2 current transformers of the same type with identical characteristics can be connected in parallel to the current measurement input CT1.This means that redundant incomers can be monitored on a main busbar section with just one ARC-MAIN-3G. The "X7" terminal must be connected using a double wire end sleeve.

Voltage / Frequency

The voltage and frequency have not an impact on the arc detection. The purpose of 3-phase voltage measurement is to show voltage levels on the display unit and enable power calculation. List of measured values:

- U12
- U23
- U31

Power

The power has no impact on the arc detection. The purpose of power calculation is to show power values on the display unit. List of calculated power values:

- Active Power P [kW]
- Reactive Power Q [kvar]
- Apparent Power S [kVA]
- cos φ

Communication interfaces

The Master MAIN supports 5 different communication interfaces:

1. INTERLINK
2. iCOM
3. IGNITION PORT (red dust-protection cap to avoid mismatches during installation)
4. Mini-USB
5. MASTERLINK

⚠ Please ensure that all communication cables are connected to the correct port. Mix-up can cause damages.

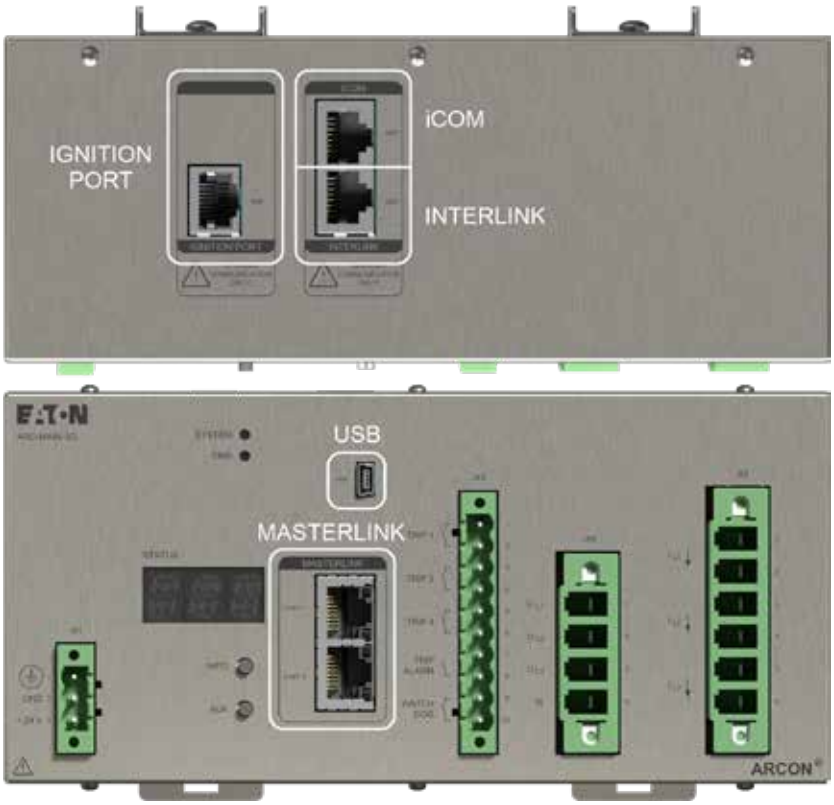


Figure 3.8 Master MAIN – Communication interfaces

INTERLINK (1xRJ45)

The INTERLINK is the interface to the Detection modules. Up to 31 Detection modules can be connected via INTERLINK.

iCOM (1xRJ45)

The iCOM is the interface to an external HMI. The external HMI is a user-friendly module which has a touchscreen display for handy operation.

IGNITION PORT (1xRJ45)

The IGNITION PORT is the interface to the Tripping module. The Tripping module is a module which operates the quenching device acted as the fastest system protection output.

Note: It can be used only when the current criteria is enabled, otherwise (only light criteria) the Tripping module will not be activated.

Mini-USB

The USB port is the interface to the PC which runs the APPT parameter tool for the system parameterization.

MASTERLINK (2xRJ45)

Using the MASTERLINK interface up to 8 Extended systems can be connected in the Complex system. For more details regarding the Complex system please refer to the section "4 – Complex System".

Detection modules

The Detection module supports up to three Line Sensors (ARC-SL), six Point Sensors (ARC-NTFS) and one Mobile Light Sensor (ARC-NTFS-MLS).

Figure 3.9 Extended system – Detection module

For the case that sensors are enabled by parameter LEDs have following states:

SYSTEM LED:

- **Orange** Not in operation
- **Red** System alarm
- **Green** In operation
- **Off** De-energized

SENSOR LED:

- **Orange** Wire fault / Short-circuit (only NTFS-sensor)
- **Red** Trip
- **Green** In operation
- **Off** Deactivated

Tripping module

The Master MAIN supports connection of one Tripping module over the IGNITION PORT.

While Tripping module is in ready state the RUN LED blinks green at 1Hz and TRIP LED is off. When Tripping module is not in ready state anymore then the RUN LED is turned off as well. When a TRIP event occurs and at least the current criteria of one phase is activated, the ignition command will be sent to the Tripping module. The TRIP LED will be on and the RUN LED off. If only the light detecting criteria is activated for arc detection, then the ignition command to the Tripping module will not be sent.

Figure 3.10 Extended system – Tripping module

RUN LED:		**TRIP LED:**	
Green 1Hz	Ready for ignition command	**Red**	Trip state
Off	NOT ready	**Off**	No trip

Arc quenching device

The arc quenching device (ARC-AT) is a 3-pole rapid short-circuit device which is able to extinguish the arc fault within less than 2 ms arc mitigation time (interval of time between the ignition of the internal arc-fault and the complete extinction of the same). Two pressure elements based on pyrotechnical principles serve as the switching drive, providing the necessary energy upon tripping to drive the switch.

In case of a busbar selective system structure one quenching device per main busbar section has to be installed in the low voltage switchgear assembly.

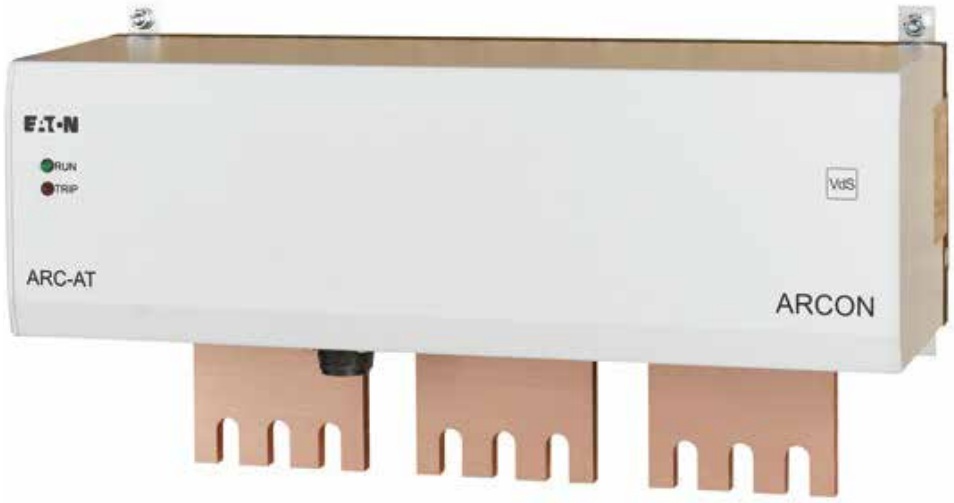


Figure 3.11 Extended system – Arc quenching device

RUN LED:		**TRIP LED:**	
Green 1Hz	Ready for ignition command	**Red**	Trip state
Off	NOT ready	**Off**	No trip

With regard to the lifespan of the pyrotechnic actuators it is recommended that the quenching device (ARC-AT) is to be replaced after 15 years of service.

The replacement of the quenching device can be done by Eaton After Sales Service or any licensed Eaton panel builder, who has special training in handling pyrotechnical equipment and are authorized to conduct this kind of operation.

Disused or tripped quenching devices must be returned to the Eaton After Sales Service for proper disposal anyway.

⚠ You are not allowed to open the ARCON quenching device (ARC-AT) under any circumstances, it contains pyrotechnic actuators that can explode and cause serious injury, if handled improperly.

Additional product characteristics in compliance with IEC 60947-9-1:2019

Subclause 5.5	Maximum voltage drop in low-impedance state	20 V (peak)
	(Maximum peak value of voltage between the main circuit terminals of the AQD, in the low-impedance state, when carrying the current corresponding to its rated short-time withstand current.)	
Subclause 5.6	Maximum operating time	0.45ms
	(Maximum time between receiving the triggering signal and the AQD steadily reaching the low-impedance state.)	
Subclause 5.8	Maximum permissible temperature of the AQD main circuit terminals	+75°C
Subclause 7	Ambient temperature in the vicinity of the AQD (during operation)	-40°C … +70°C

Display / External HMI

The user navigates through the menu using the resistive touchscreen. The large graphic display allows the user to view all important data briefly.

Figure 3.12 Display / External HMI

The resolution of the display is 320x240 pixels.

The status bar on the bottom of the display contains following information:

- Operation mode
- Date
- Time

There are three hardware buttons:

- Two navigation buttons for shifting on main page
- ACK button for acknowledging all active events

There are two LEDs:

- SYSTEM
- TRIP

If the display module is turned on but not connected with Master MAIN or parameter for display is not enabled, then following text will be shown:

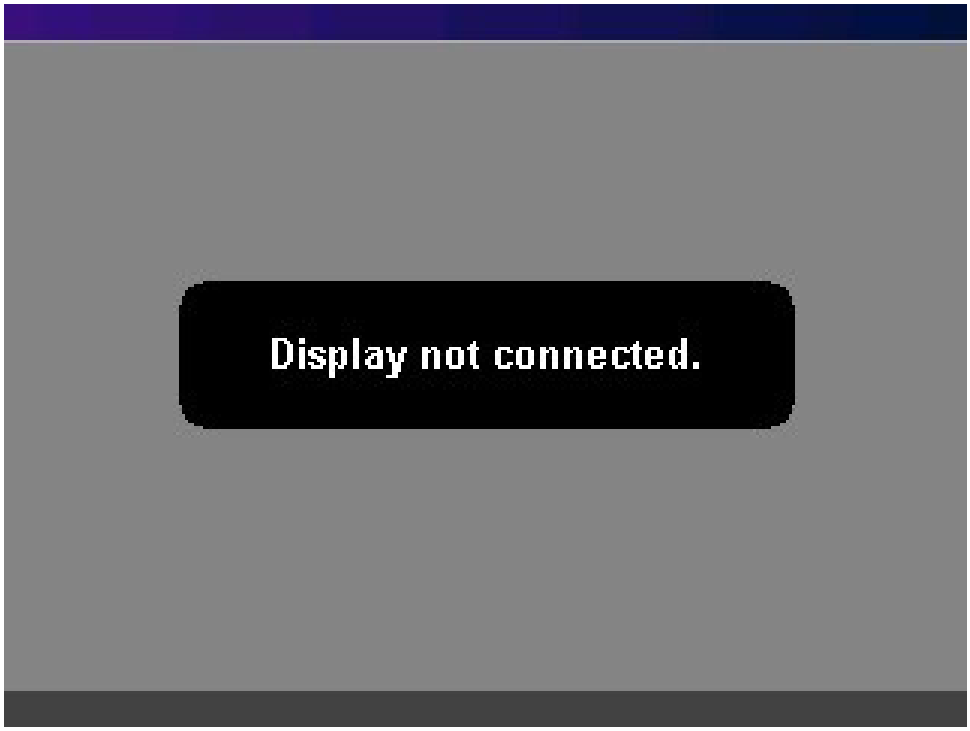


Figure 3.13 Display / External HMI – Display not connected

Main

The first page that appears after power on and successful finished initialization process is the “Main” page.

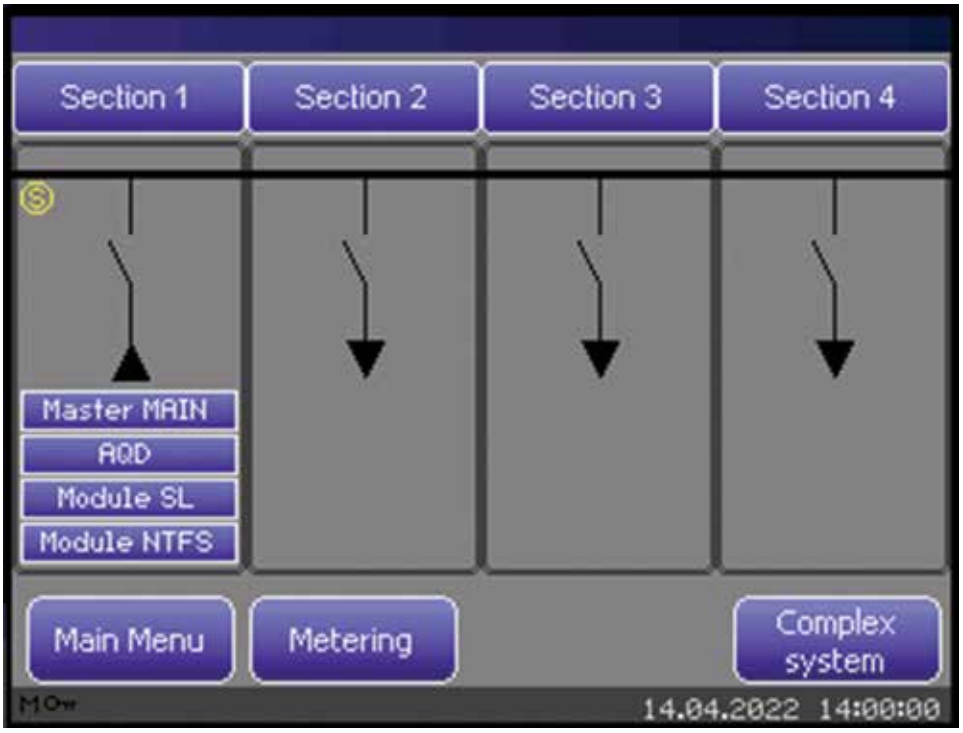


Figure 3.14 Display / External HMI – Main page

The main page shows the parameterized number of sections and the single line diagram indicates the type of section. In the section there are fields reserved for displaying of rectangular shapes for master module, light detection module, Tripping module, quenching device and sensor. The shapes will be shown only if component is parameterized. On the top of each section the parameterized section name is shown.

If user presses anywhere on the section area, then the detailed section information page will be opened. A list box shows all modules and sensors which are placed in the selected section. For more information about modules and sensors the user can click on the relevant part.

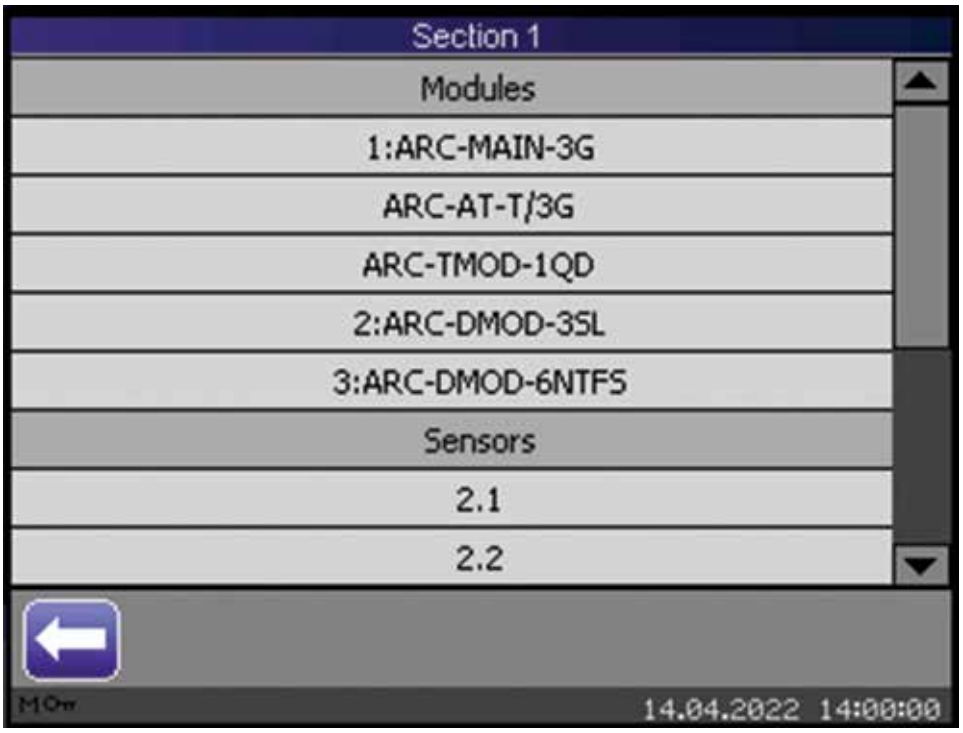


Figure 3.15 Display / External HMI – Section info

Module info page for master

Module info page for master contains following specific information.

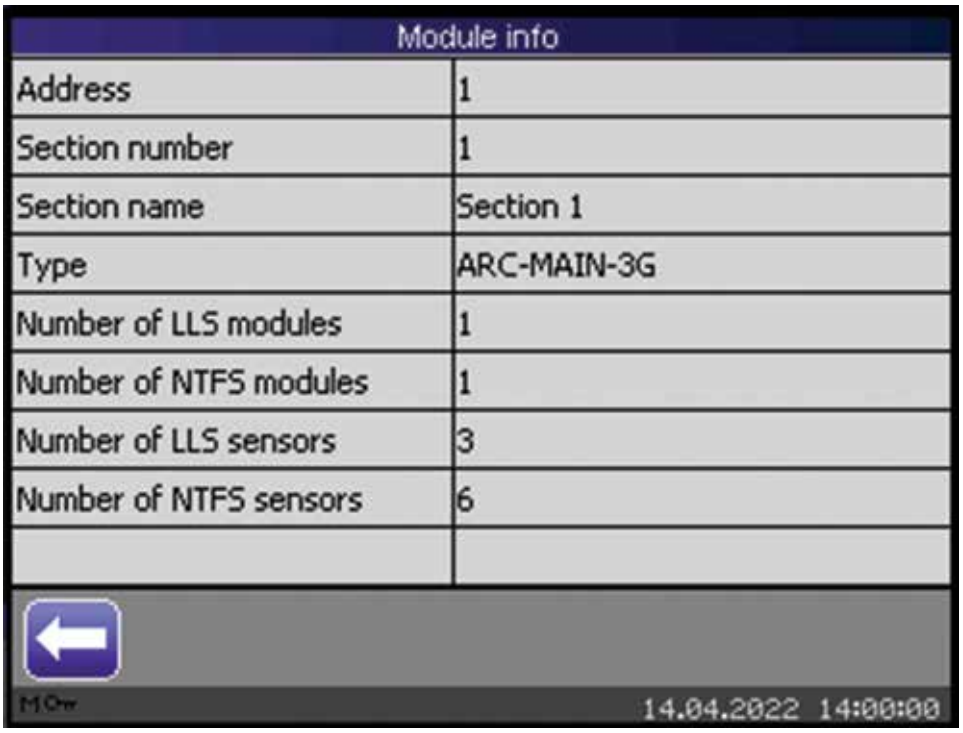


Figure 3.16 Display / External HMI – Module info page – Master

Module info page for Detection module

Module info page for Detection module contains following specific information

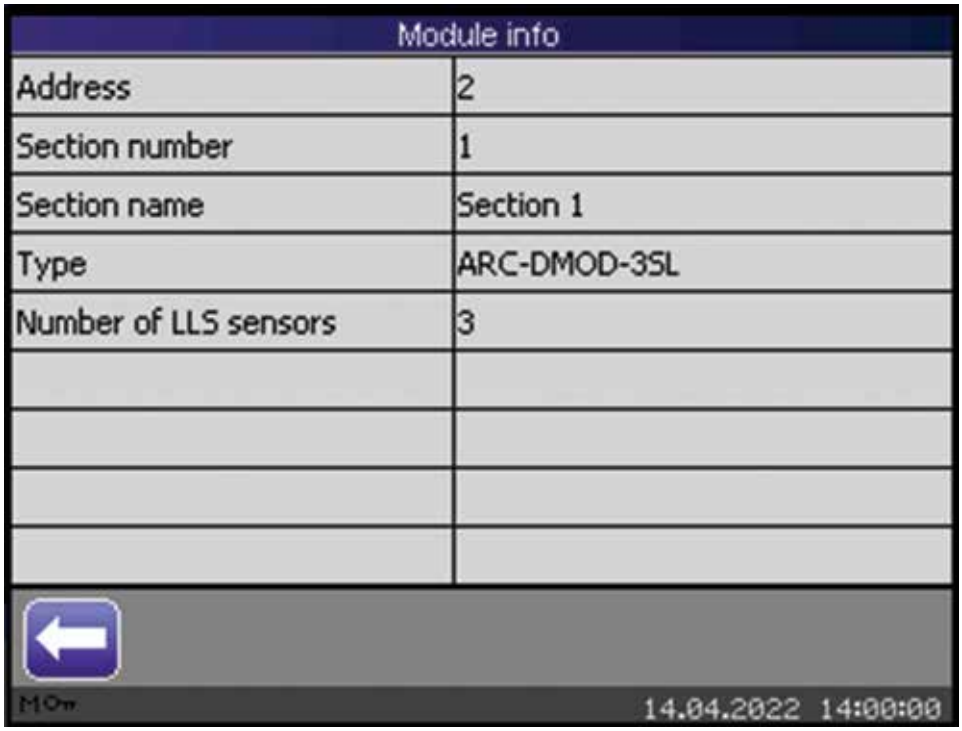


Figure 3.17 Display – Module info page – Detection module

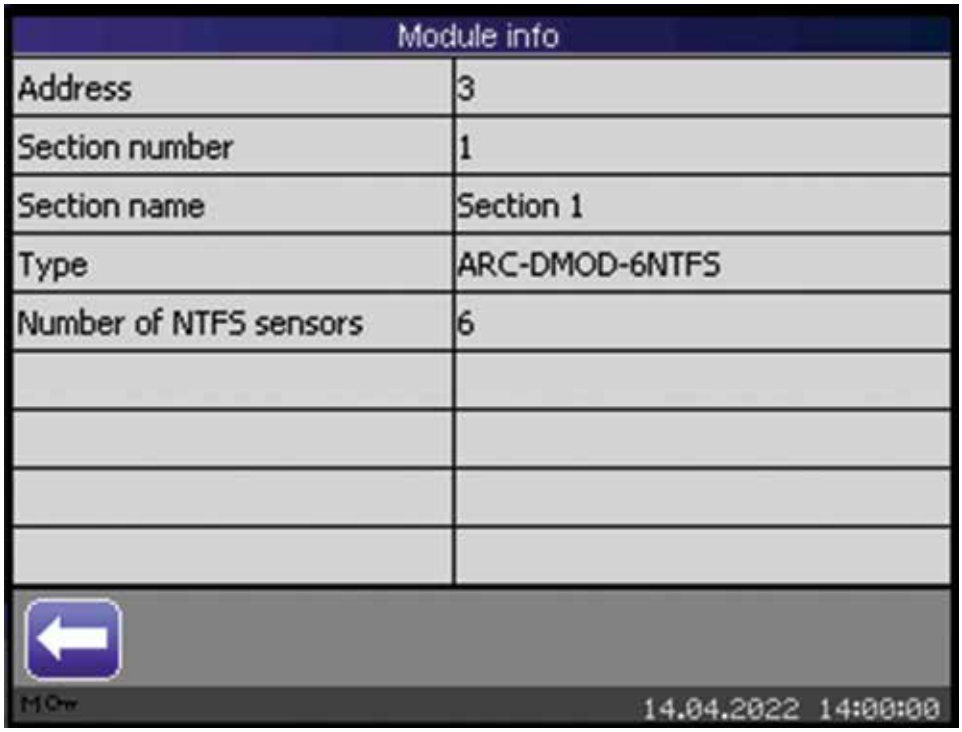


Figure 3.17a Display – Module info page – Detection module

Sensor info page for Line sensor

Sensor info page contains following specific information.

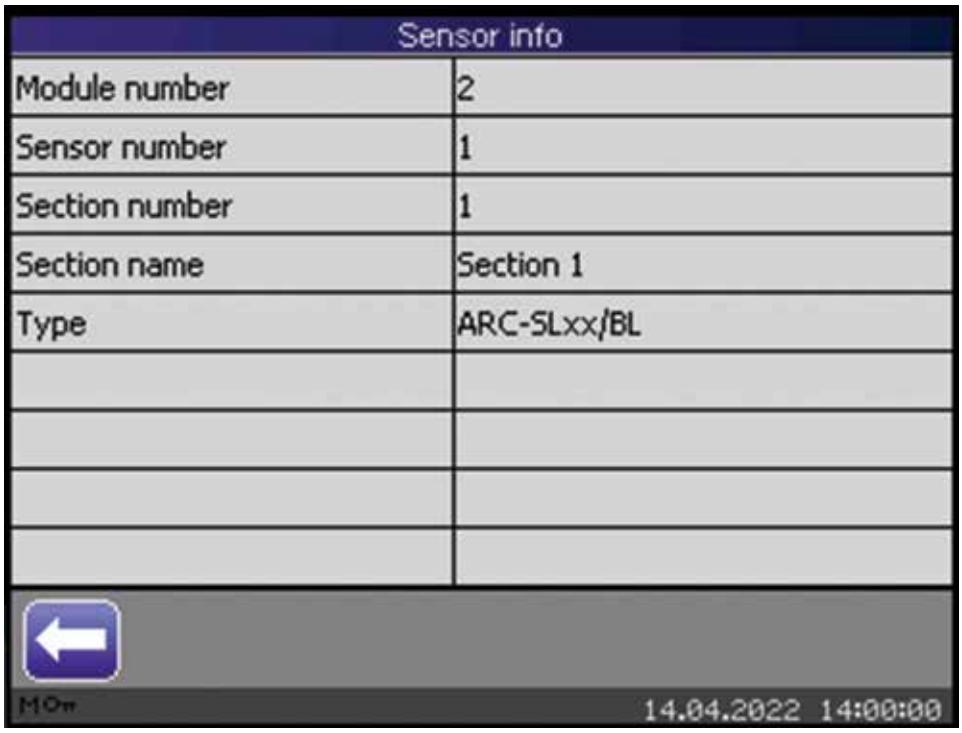


Figure 3.18 Display – Module info page – Sensor

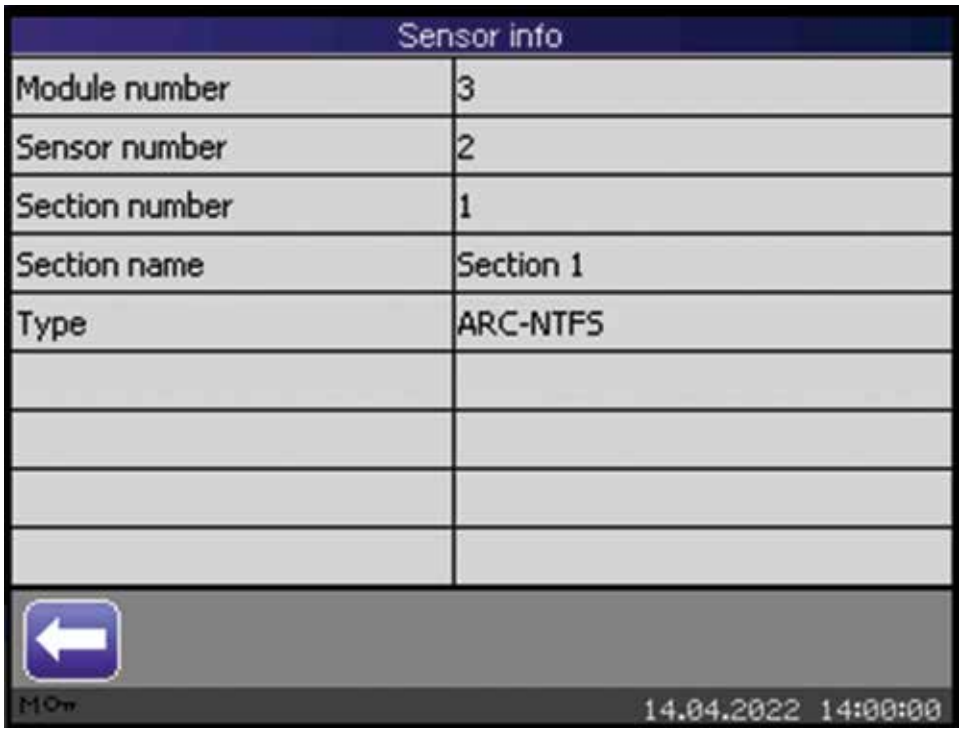


Figure 3.18a Display – Module info page – Sensor

Metering

From Main page it is possible to open Metering page which contains following data:

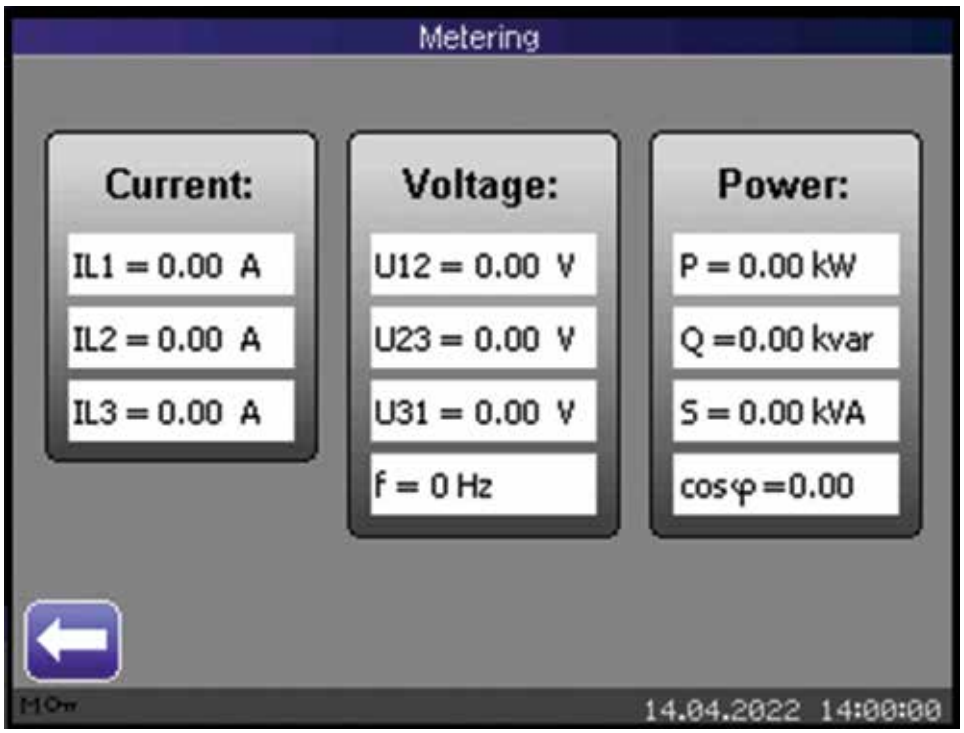


Figure 3.19 Display – Metering

Menu

The "Main Menu" appears when user clicks on the "Menu" button

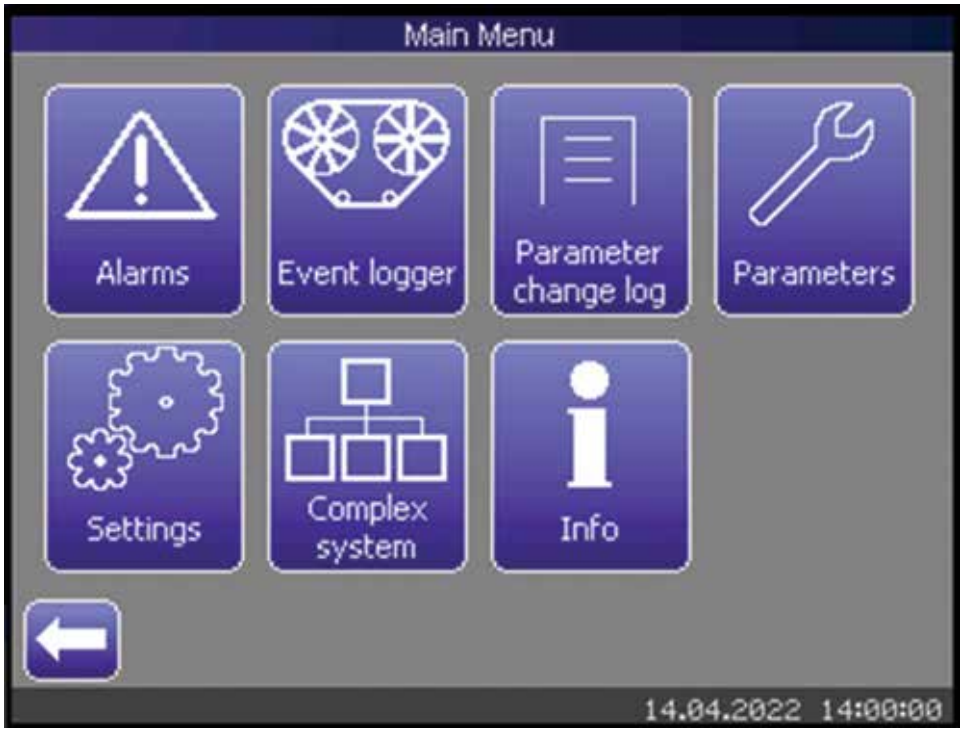


Figure 3.20 Display – Main Menu page

Alarms

For the detailed description of alarms see chapter "3.11 Events & Alarms" When an alarm occurs, the page "Alarms" will be opened automatically. This page contains following information:

Element	Description
No.	Event number
Event	Event text
Section	Affected section (Section name)
Module	Affected module address
Sensor	Affected sensor address

Table 3.2: Display – Alarm table structure

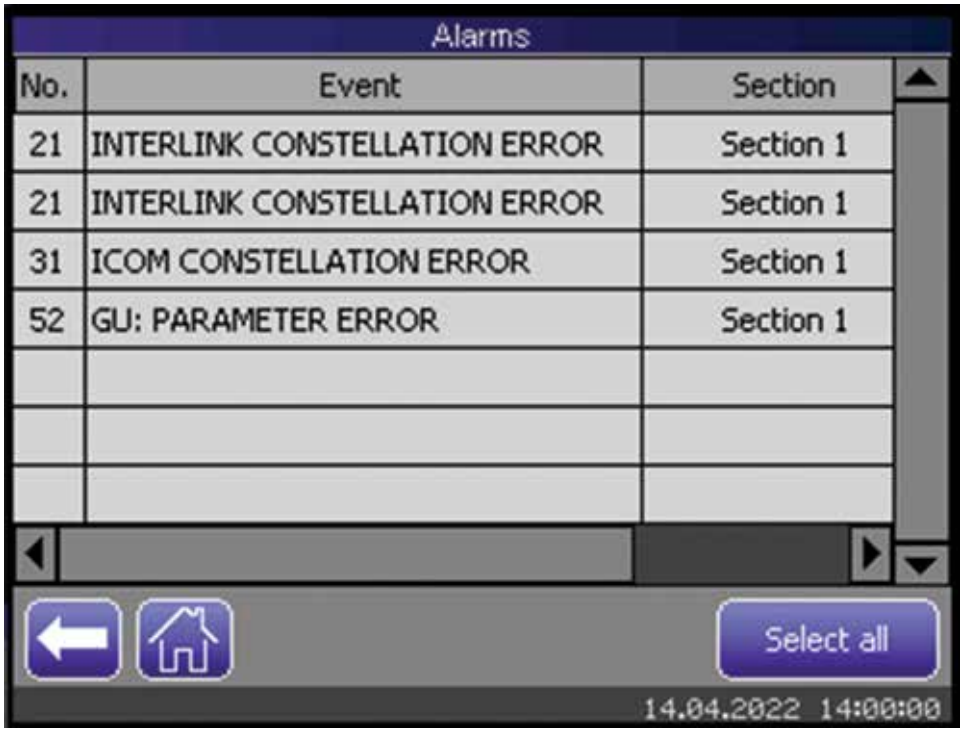


Figure 3.21 Display – Alarms page I

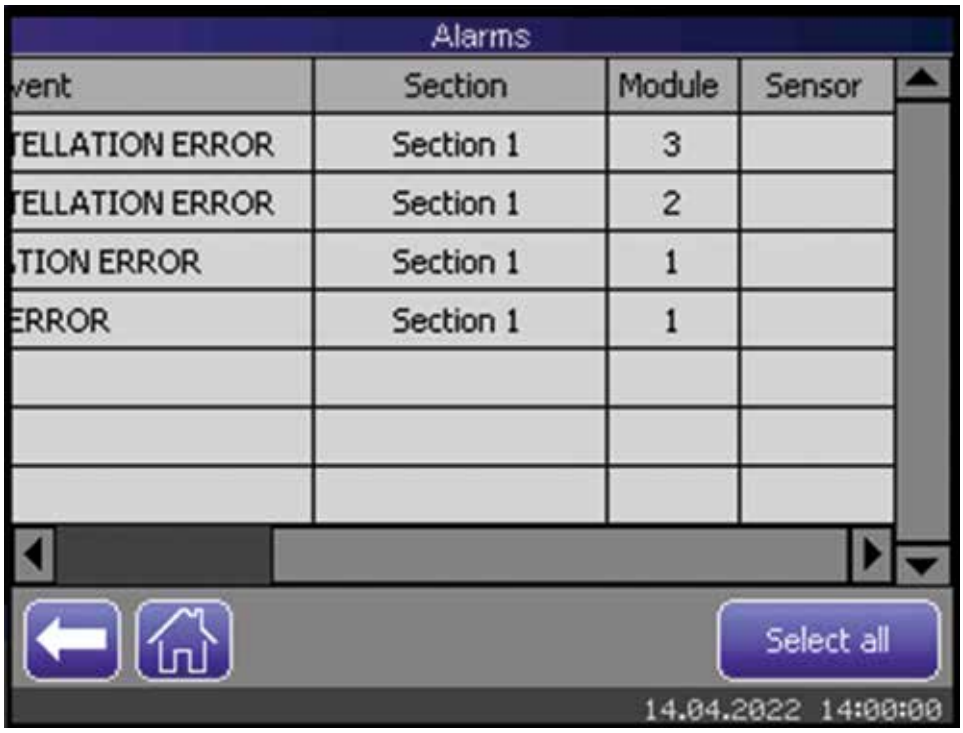


Figure 3.22 Display – Alarms page II

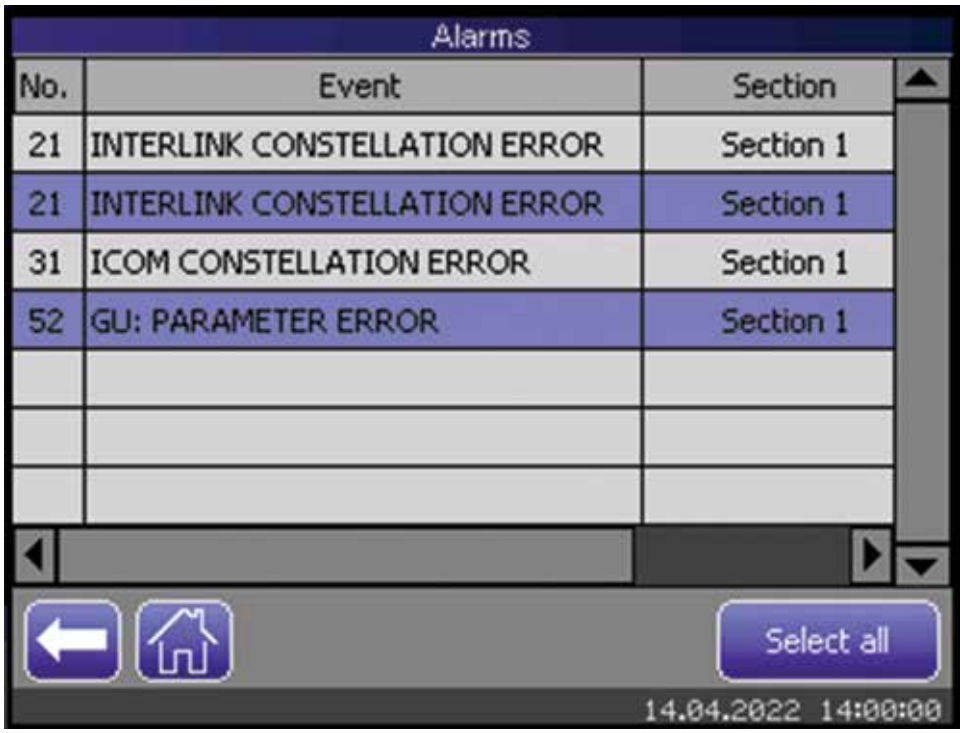


Figure 3.23 Display – Alarms page III

User is free to choose only some or all alarms via touchscreen, by selecting the corresponding row or by clicking on the button "Select all". Pressing of hardware button "ACK" acknowledges selected alarms. An alarm disappears from alarm table only if it is acknowledged and its trigger condition is false.
Also, user can acknowledge an alarm using hardware ACK button on the master module. Holding ACK button longer than 2s all alarms will be acknowledged if trigger conditions are false.

Event logger

For the detailed description of events see chapter "3.11 Events & Alarms" The Event logger saves up to 100 events by using the first-in-first-out (FIFO) principle in the Event Logger

File (ELF). Each entry provides following information:

Element	Description
No.	Event number
Event	Event text
Date	Date
Time	Time
Section	Affected section (Section name)
Module	Affected module address
Sensor	Affected sensor address

Table 3.3: Display – Event logger table structure

Figure 3.24 Display – Event logger page I

Figure 3.25 Display – Event logger page II

Events are recorded with 1 ms interval and will be displayed in chronological order. The latest event is on the top of the event list. To scroll the list either use button Up/Down or the scroll bar on the right of the display.

If user wants to reset the Event logger and the user protection mode is enabled, it's only possible by password.

To refresh the displayed event list automatically, an "Auto Refresh" button is available on the screen. Green "Auto Refresh" button will activate automatic refresh. Grey "Auto Refresh" button will deactivate automatic refresh of the displayed event list.

When using the scroll bar or button Up/Down, the automatic refresh of the event list is being stopped ("Auto Refresh" button is grey).

In the displayed event list active events are highlighted green and inactive events are represented with grey background colour.

The Event logger is part of "Tools" in the APPT. See chapter "3.8.5 Tools".

Parameter change log

The Parameter change log saves up to 100 entries by using the first-in-first-out (FIFO) principle. Each entry provides following information:

Element	Description
No.	Parameter number
Parameter	Parameter text
Date	Date
Time	Time
Old	Old value
New	New value
Unit	Unit of parameter

Table 3.4: Display – Parameter change log table structure

Figure 3.26 Display – Parameter change log page I

Parameter change log entries are recorded with a temporal resolution of 1 ms and will be displayed in chronological order. The latest parameter change log entry is on the top of the parameter change log list.

Figure 3.27 Display – Parameter change log page II

If the parameter change log contains parameters "Device name", "Device description" or "Section x/Name" by clicking on row a new window will be opened and parameter value will be displayed.

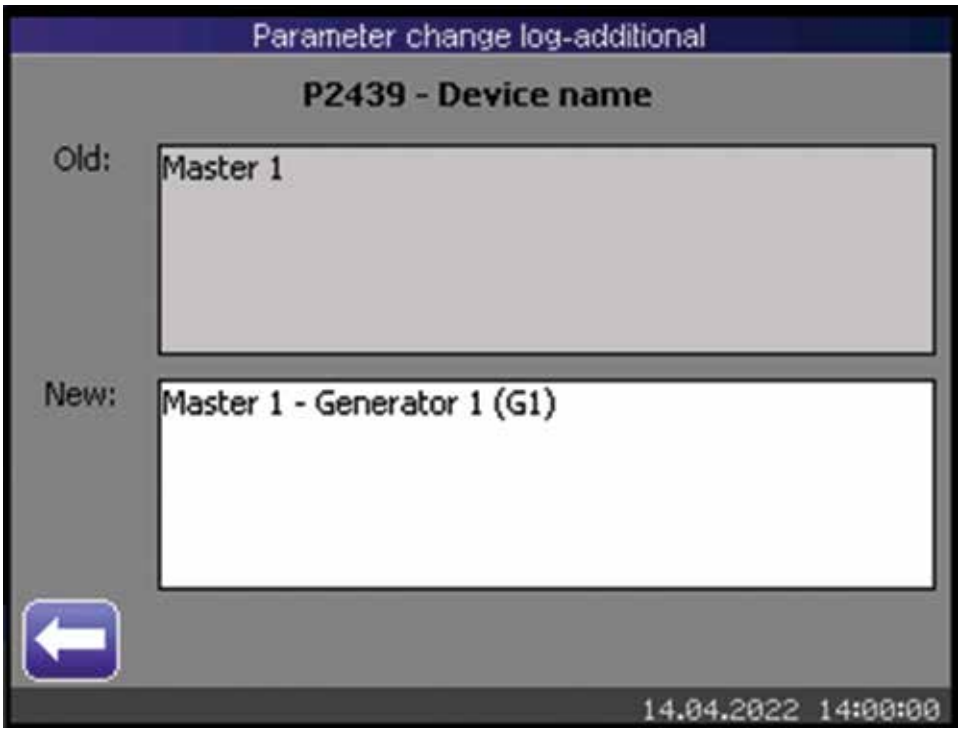


Figure 3.28 Display – Parameter change log - additional page

The Parameter change log is part of "Tools" in the APPT.

Parameters

For the detailed description of parameters see chapter "3.10 Parameters".
For "Master MAIN" configuration the parameter setting can be conducted either

- by configuration software "Arc Protection Parameter Tool (APPT)" or
- by using the touchscreen of the device

Note: For the first setup the APPT is always needed!

The display module provides possibility for users to view and edit parameters. Here is the root path of parameter structure:

Figure 3.29 Display – Parameters page I

Parameters are displayed as follows:

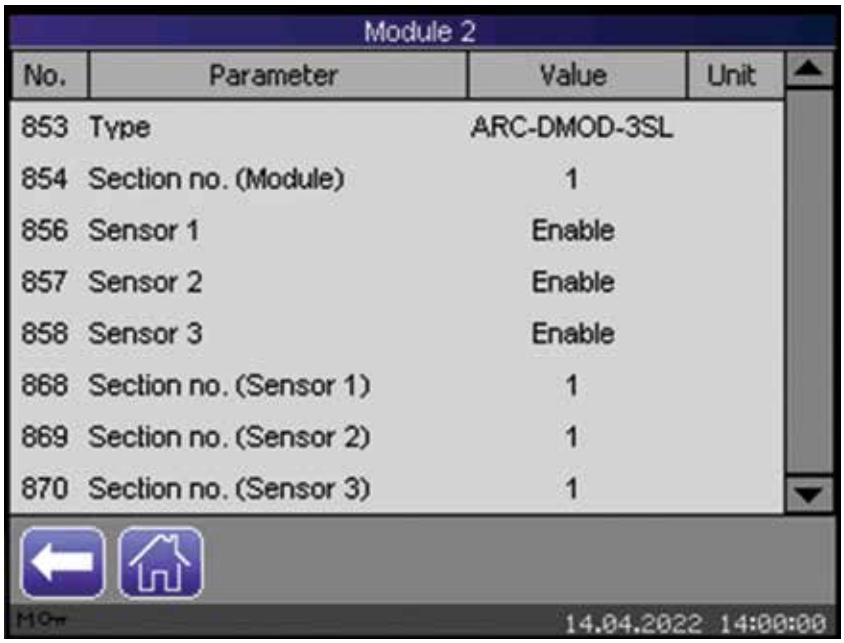


Figure 3.30 Display – Parameters page II

"Master MAIN" configuration via touchscreen

If user wants to change parameters and the user protection mode is enabled, it's only possible by password. When entering "Parameters" page user will be asked if he wants to change parameters.

Figure 3.31 Display – Parameter edit page I

When the user browses through the parameters in edit mode, it's possible to edit the parameters in different variations as follows:

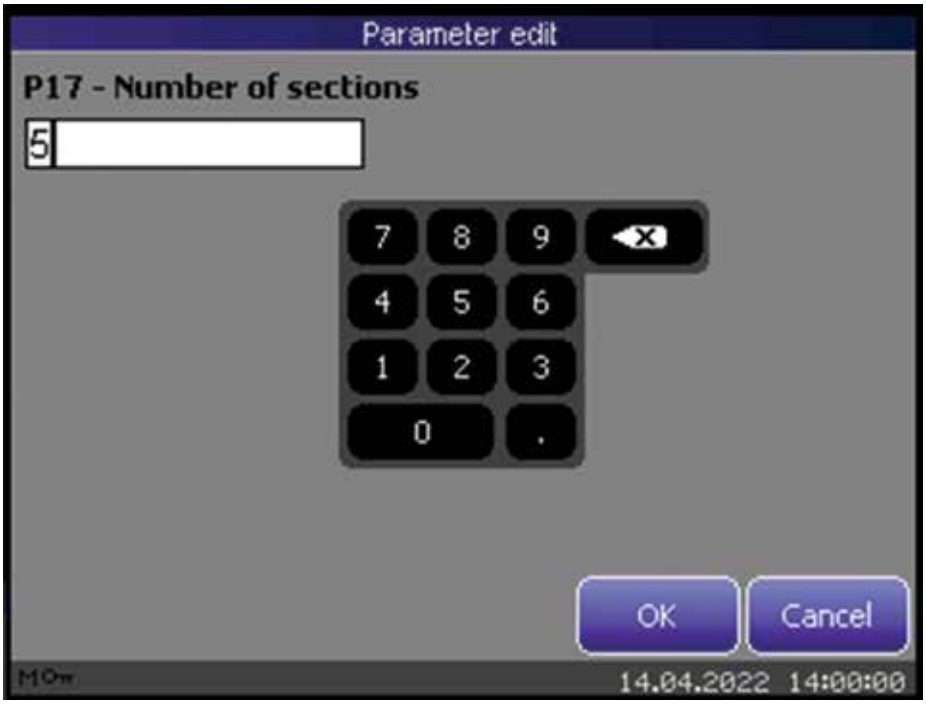


Figure 3.32 Display – Parameter edit page II

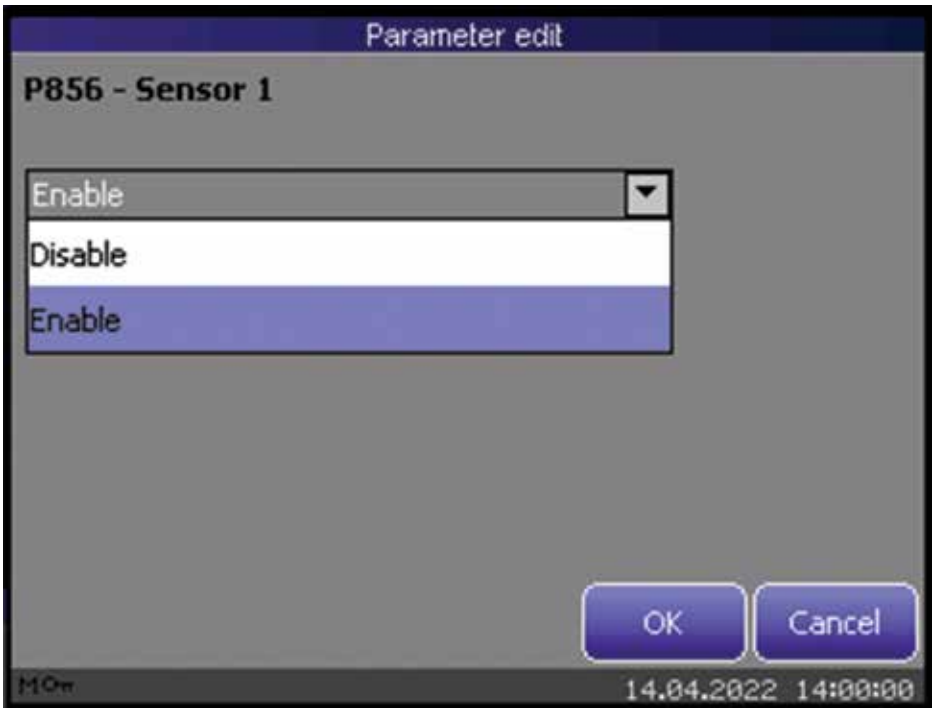


Figure 3.33 Display – Parameter edit page III

Figure 3.34 Display – Parameter edit page IV

Any modification of parameter setting will be highlighted by "*" symbol in column "No." and background colour for page title will be red.

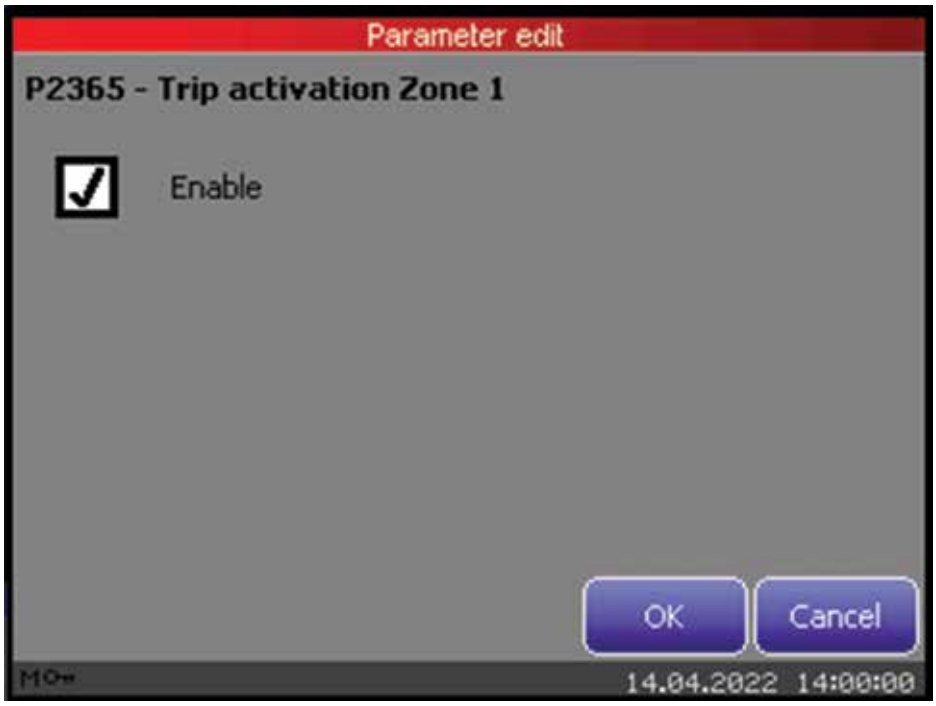


Figure 3.34a Display – Parameter edit page V

Operating "Back" arrow button provides further changing of any other parameter setting of other submenus.

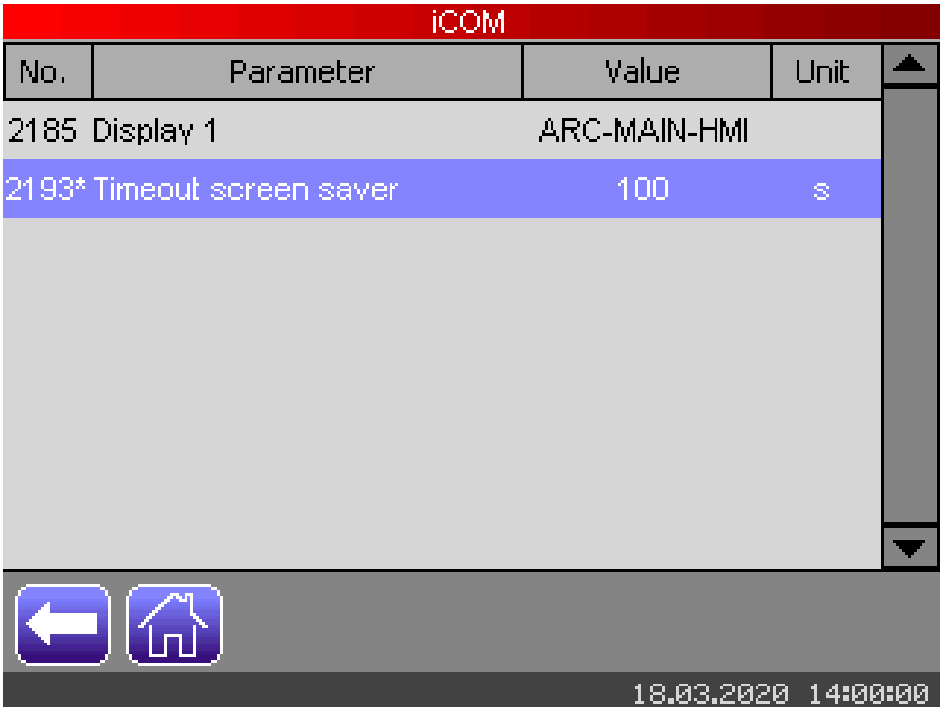


Figure 3.35 Display – Parameter edit page VI

If the user leaves the section parameters, "Save changes" page will be displayed. The user can accept the changes of parameters by pressing the button "Apply" or reject changes of parameters by pressing the button "Discard". After pressing the buttons "Apply" or "Discard", "Main" page will be displayed. By pressing the "Cancel" button the user gets back to the parameters section and no changes will be saved.

Figure 3.36 Display – Parameter edit page VII

If user presses button "Apply" device perform software system restart.

Figure 3.37 Display – Parameter edit page VIII

Settings

This page allows changes to device settings brightness of LC-display, menu language and time, entering different user levels and password recovery.

Figure 3.38 Display – Settings page

Display

The brightness can be controlled with the touch-screen slider. Also, menu language, date and time can be set.

Daylight saving time

The parameter "Daylight saving time" is used for automatic time changeover at the yearly repeating summer-wintertime dates. The automatic "Daylight saving time" switch ("+1h" at 01:00 "Coordinated Universal Time (UTC)" or "Greenwich Mean Time (GMT)" on last Sunday in March and "-1h" at 01:00 UTC on last Sunday in October) can be deactivated/ activated via parameter "Daylight saving time".

- :automatic time change is deactivated,
- :automatic time changeover is activated

Local time zone

The local time zone can be adjusted via parameter "Local time zone" (±12 hours offset to "Coordinated Universal Time (UTC)" or "Greenwich Mean Time (GMT)").

The Master MAIN uses UTC time format.

Date:

- Day / Month / Year

Time:

- Hour / Minute / Second / Millisecond

Zone:

- Time zone
- DST - Daylight Saving Time

The Master MAIN adds a time stamp to every logged event in the event log file and on every logged parameter change in the parameter change log file, also the time and date will be shown on the display unit. In this purpose the Master MAIN requires setting of time and date by user. Time and date can be set by:

1. Display unit (External HMI)

2. Parameter tool (APPT)

Figure 3.39 Display – Display settings page

Languages

Following languages are available: German, English, French and Spanish

User Level

Changing to the protected user mode level via touchscreen is possible under "Change User Level". To change user level, a 5-digit password must be entered via the number keypad on the touchscreen. By pressing "OK" the required user level will be activated. Password for protected user mode is adjusted in "Parameters/SECURITY", parameter name is "Password". The timeout for protected user mode is a parameter which can be adjusted in "Parameters/SECURITY", parameter name is "Timeout".

Figure 3.40 Display – Chage user level page

Down in left corner the small symbol "Key" indicates activation of protected user mode.

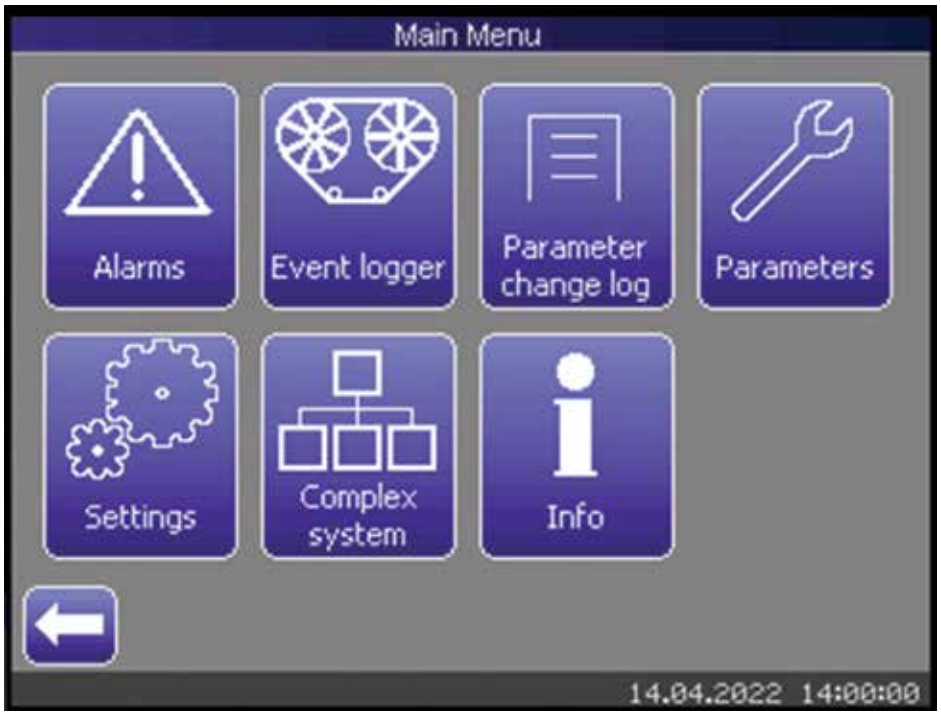


Figure 3.41 Display – Protected user mode

Button colours

Settings of colour layout for menu pages' components can be changed for the following ranges:

- Background colour of hotkey lower half (Button Bottom)
- Background colour of hotkey upper half (Button Top)
- Text colour of Hotkeys (Button Text)

Figure 3.42 Display – Button colours page

Info

The "Info" page provides information about hardware, firmware and files.This information is stored in General Information File (GIF).

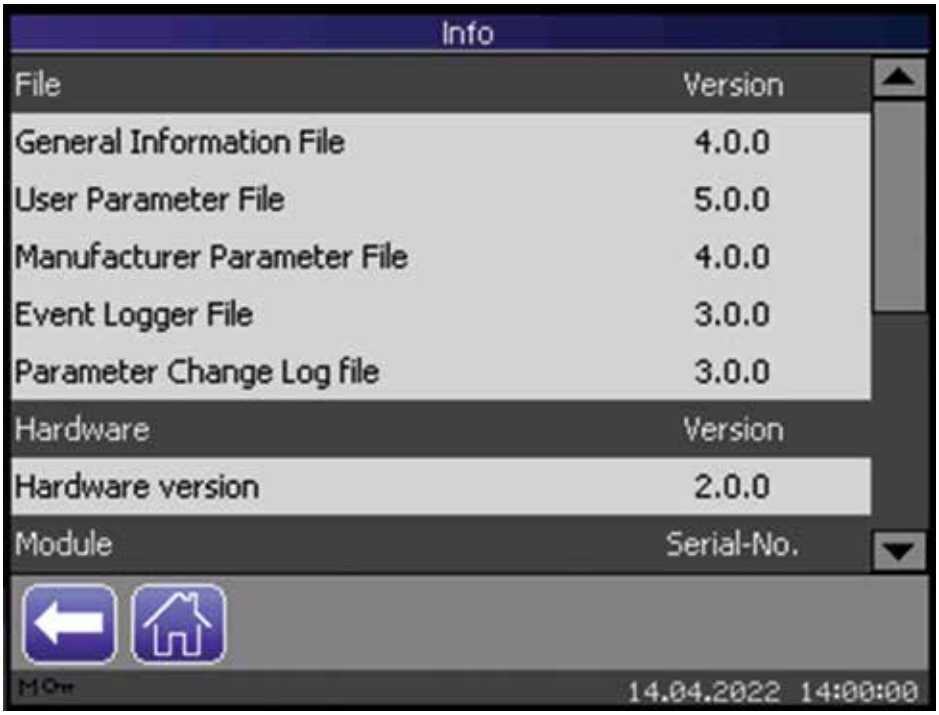


Figure 3.43 Display – System information page I

Figure 3.44 Display – System information page II

Dragging

The width of the header items can be managed by dragging the dividers.

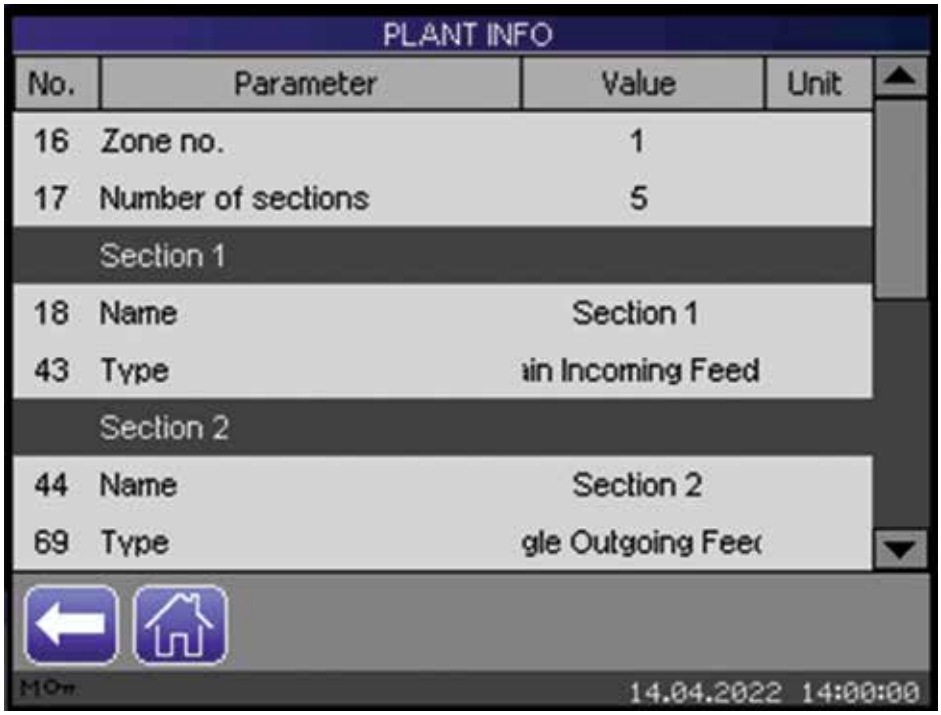


Figure 3.45 Display – Dragging the dividers I

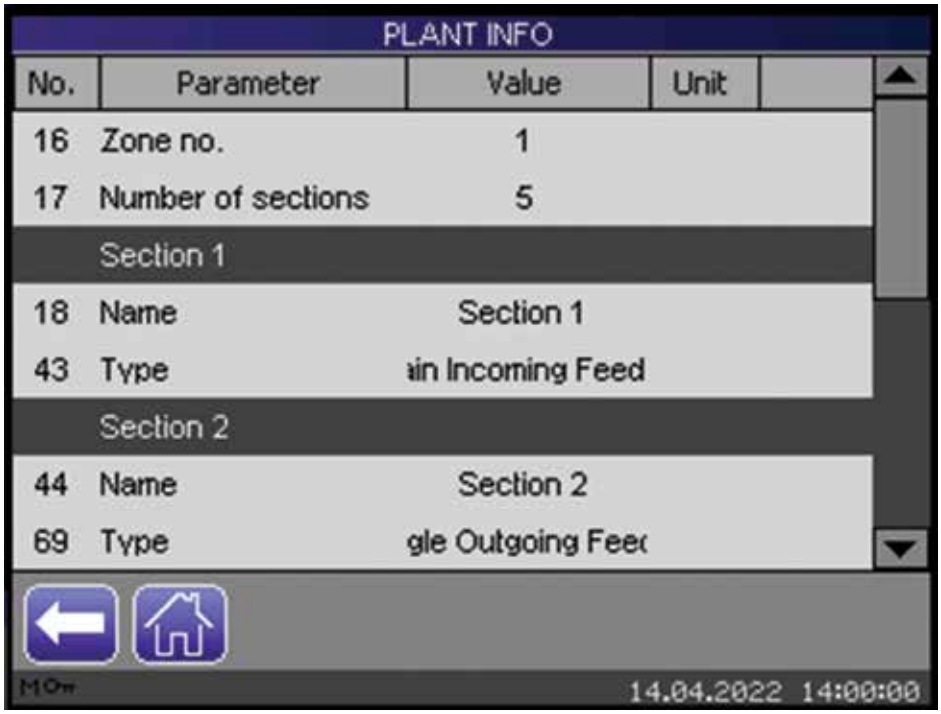


Figure 3.46 Display – Dragging the dividers II

Complex System Status page

The Complex System Status page on the HMI is showing the actual status of all over iCOM connected devices. If you want to connect to or disconnect from an Extended Master with the actual HMI you need to press on the relevant line.

Figure 3.46a Display – Complex System Status page I

<<FULL ACCESS >>	=	The actual HMI you are using. Reset, parameter changes, etc. are possible.
Master 2 - HMI 2	=	Another HMI with address 2 is connected to Master Extended with address 2
ACCESS "Yes"	=	You are able to access to this Master Extended over the actual HMI.
ACCESS "10s"	=	For this time the HMI is not accessible because another HMI is already connected
ACCESS "No"	=	No access possible
SYSTEM "Green"	=	Master Extended system is ok
SYSTEM "Orange"	=	Master Extended system initialization in process
SYSTEM "Red"	=	Master Extended system has a failure
TRIP "Red"	=	Master Extended has tripped
M1	=	Address of the Master Extended system
Acknowledge alarms	=	Acknowledge all connected Master Extended systems

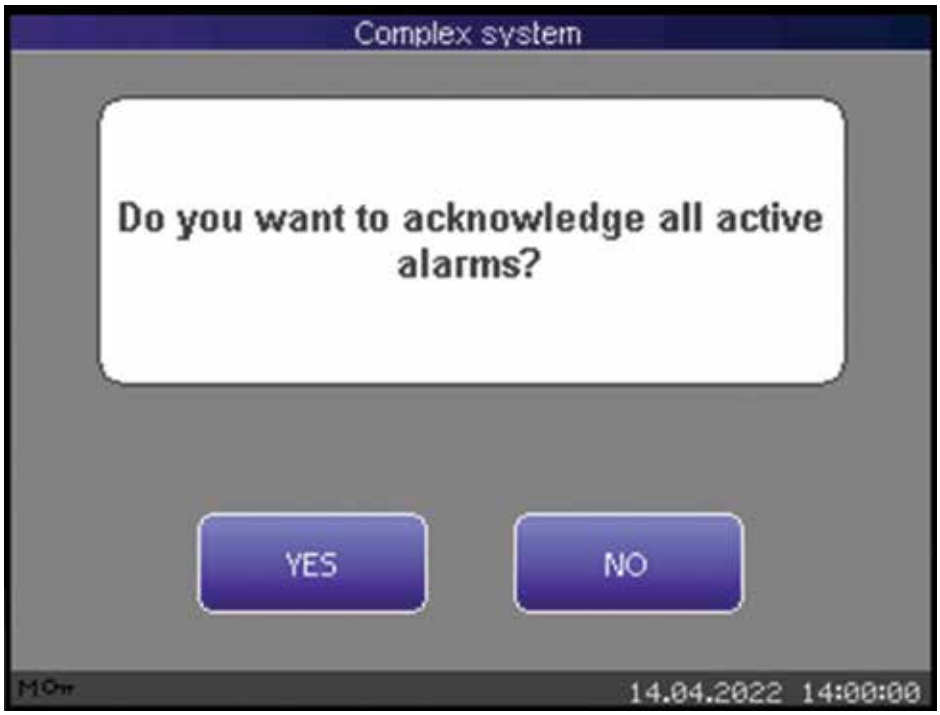


Figure 3.46b Display – Complex System Status page II

Figure 3.46c Display – Complex System Zone definition overview

Arc Protection Parameter Tool (APPT)

The purpose of Arc Protection Parameter Tool (APPT) is communication between user's PC and the Master MAIN. APPT requires minimum Windows 7 operating system and NET Framework 4.5.

With Windows 10, the required USB driver will be installed automatically; with older versions of Windows, you have to install it manually in the device manager.

The driver can be found in the installation path of the APPT software in the folder "driver".

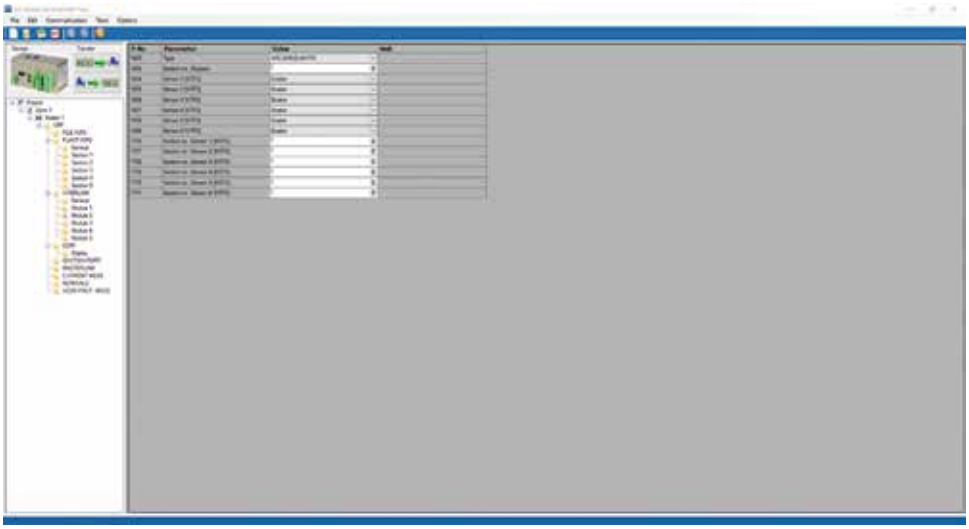


Figure 3.47 APPT – Main window

Application consists of 5 parts:

1. Main Menu
2. Toolstrip bar (icons)
3. Tree view navigation
4. Working area
5. Application state

Main Menu

At the top of the window, there will be the Main Menu, with the following sub-menu items:

- File
- Edit
- Communication
- Tools
- Options

File

The File sub-menu contains the following items:

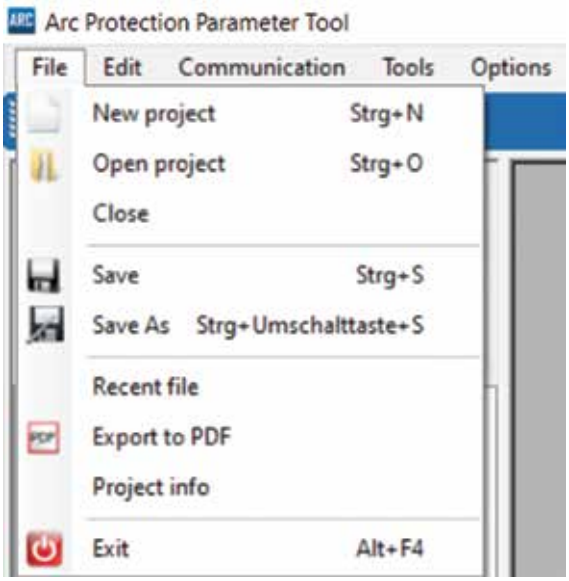


Figure 3.48 APPT - file sub-menu

- **New Project**
  by clicking this sub-item, the Create New Project window opens and user will be asked to name the project. As the application supports reading one document at time, the user will be asked to save the previous one (if any), before creating the new one.
- **Open Project**
  Open the existing project. Allowing the user to browse the files.
- **Close Project**
  Close the current project.
- **Save**
  Save changes in project (if any).
- **Save As**
  Save the project and set its name.
- **Recent Files**
  Show the list of recent projects (max. 10 projects).
- **Export to PDF**
  Exports the project as PDF File.
- **Project info**
  Open the window like Create New Project window, the user can change the project data.
- **Exit**
  Exit the application.

Edit

The Edit sub-menu will contain the following items:

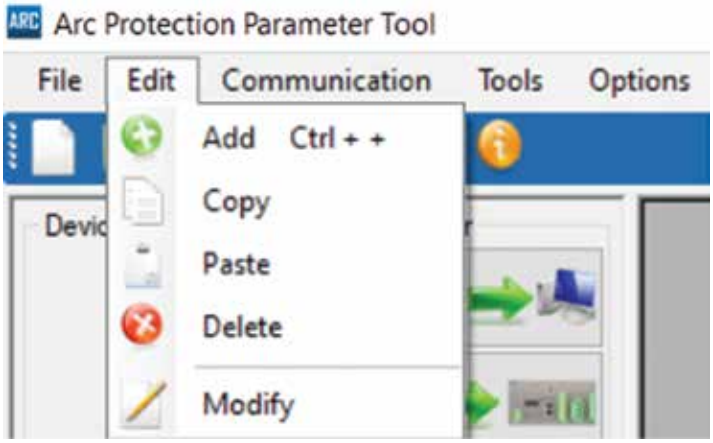


Figure 3.49 APPT – Edit sub-menu

- Add

By selecting the Add item, new "Zone" (= protection zone) or "Master" (within one protection zone) will be created. If selected node is project, it will add "Zone" and if selection is on "Zone" it will add new "Master" within that zone. Root node for adding the additional device will be called zone node, by default, although the user will be able to change the text of the node. The form that collects the name and the description of the node could look like the following one:

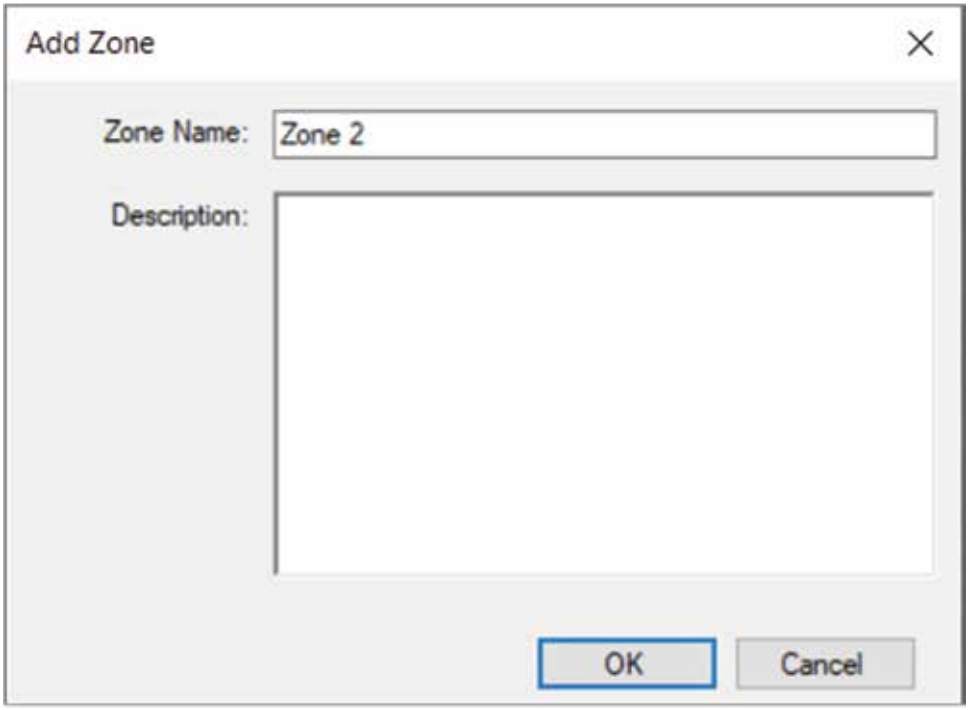


Figure 3.50 APPT - Add Zone

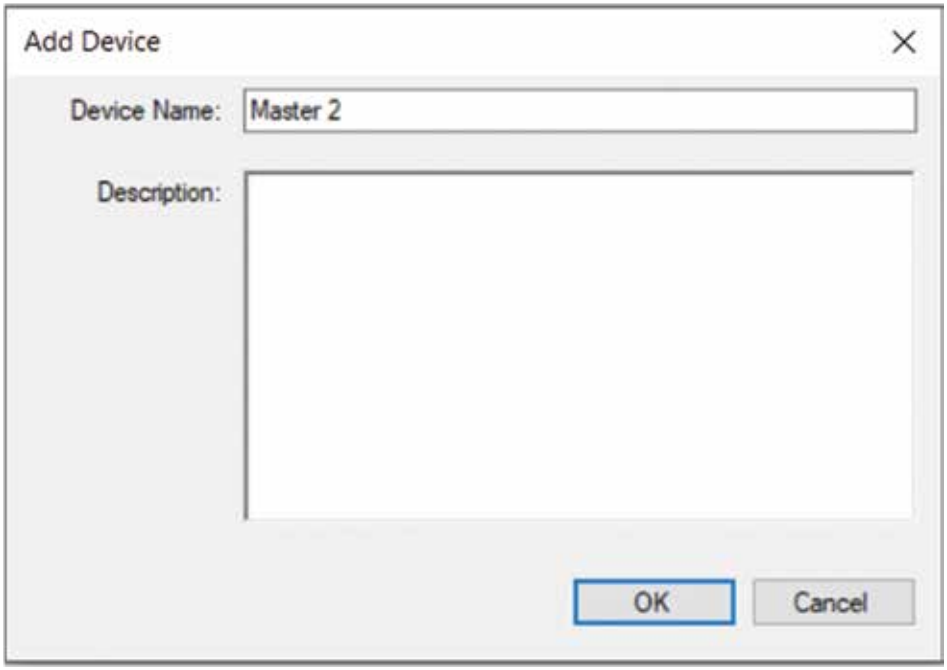


Figure 3.51 APPT - Add Master

- Copy & Paste
  Selected devices and substations can be copied and pasted.
- Delete
  Deletes the item selected by the user (only Zone or Master)
- Modify
  Modifies selected item

Communication

The Communication sub-menu contains two items:

Figure 3.52 APPT – Communication sub-menu

- Read from device
  APPT reads following device files: GIF and UPF
- Write to device APPT writes the UPF (file) to the device.

Tools

The Tools sub-menu contains two items:

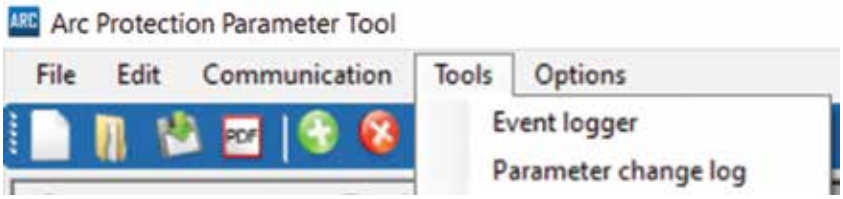


Figure 3.53 APPT – Tools sub-menu

- Event logger
  The Event logger menu item opens the Event logger window.

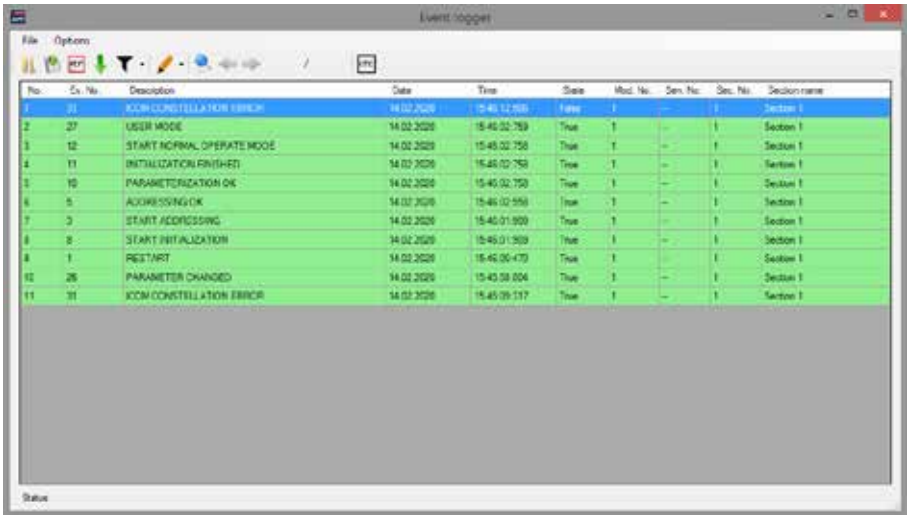


Figure 3.54 APPT – Event logger

- Parameter change log
  Like Event logger, this window will work as independent tool. The main purpose of this window is manipulating with Parameter Change Log Files. Maximal number of parameter changes which can be stored is 100.The structure of the window will be the same as the structure of Event logger window.User will be able to observe the following parameters:
  - Order number
  - Parameter number
  - Description
  - Date
  - Time
  - Old value
  - New value
  - Unit

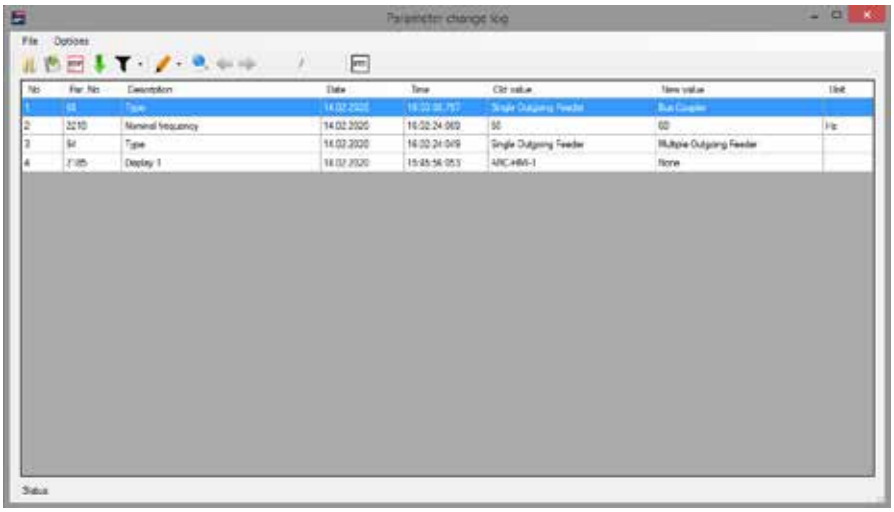


Figure 3.55 APPT – Parameter change log

Options

The Options sub-menu contains two sub-items:

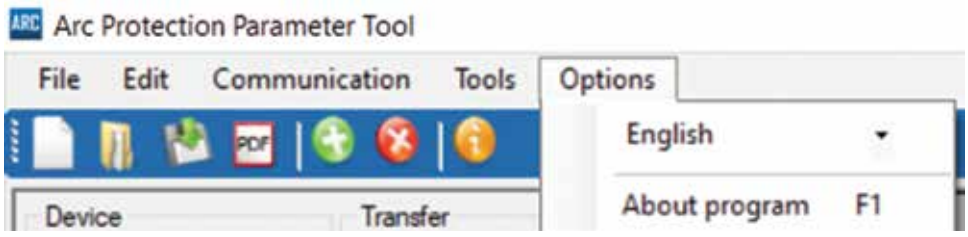


Figure 3.56 APPT – Options sub-menu

- Language
  Combo-box, which allows the user to select the language. Languages will be hard-coded. The following languages will be listed: German, English, French and Spanish.
- About program
  Here the actual version of the tool is shown

Toolstrip bar (icons)

To allow the user quick access to frequently used functions, the Icon Bar will be added. Icon bar will contain the following icons:

- New project
- Open project
- Save
- Export to PDF
- Add
- Delete
- About

The function of any of these buttons is the same as the function of the corresponding items in the Main menu.

Tree view navigation

Tree view navigation is used for displaying complete list of "Project", "Zone" and their "Master" devices. "Master" can only be part of "Zone". "Zone" can be only sub node of "Project". Limit of "Master" per "Zone" is 8. Additional context menu appears when right clicking on "Project", "Zone" or "Master" tree node. (see example below)

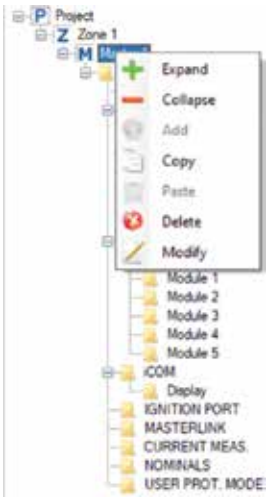


Figure 3.57 APPT – context menu

The function of any of these buttons is the same as the function of the corresponding items in the Main menu.

Working area

In this area parameters are displayed with their names, Parameter-Number (P-No), values and units.

Values of parameters can be edited in this area.

Application state

This area is reserved for status bar.

Status bar gives information about operation mode of application.

Parameterization

Parameters can be changed from Arc Protection Parameter Tool (APPT) or directly on the display module.

APPT

Supports changing of all parameters according to the mode which is activated. Changed file will be uploaded into the master over USB.

Following steps will be executed in case of UPF parameter change:

1. Download parameters to device.
2. All changed parameters, old and new values, will be written in the PCL file.
3. Master MAIN restarts and initializes the system

Display

Supports changing of all parameters according to the mode which is activated.

Following steps will be executed in case of UPF parameter change:

1. Download parameters to device.
2. All changed parameters, old and new values, will be written in the PCL file.
3. Master MAIN restarts and initializes the system

Parameters

Master MAIN requires User Parameter File (UPF) for correct function. UPF file contains user parameters which are described on the next pages:

Root	Subfolder	Parameter	Range	Description
FILE INFO				
		Main version	0…65535	
		Subversion	0…65535	
		Revision	0…65535	
PLANT INFO				
		Number of sections	1…32	Number of sections in zone
	Section 1			
		Name	Up to 24 characters	Name of section
		Type	Main Incoming Feeder / Single Outgoing Feeder / Multiple Outgoing Feeder / Bus Coupler / Busbar Section / Blank Section	Type of section
	Section 2			
		Name	Up to 24 characters	Name of section
		Type	Main Incoming Feeder / Single Outgoing Feeder / Multiple Outgoing Feeder / Bus Coupler / Busbar Section / Blank Section	Type of section
…	….	….	….	….
	Section 32			
		Name	Up to 24 characters	Name of section
		Type	Main Incoming Feeder / Single Outgoing Feeder / Multiple Outgoing Feeder / Bus Coupler / Busbar Section / Blank Section	Type of section
INTERLINK				
	General			
		Number of modules	2..32	Number of connected modules on INTERLINK
	Module 1			
		Type	ARC-MAIN-3G	Type of master module
		Section no. (Module)	1…32	Number of sections in which module is placed
	Module 2			
		Type	ARC-DMOD-3SL / ARC-DMOD-6NTFS	Type of first sensor`s module
		Section no. (Module)	1…32	Number of sections in which module is placed
		Sensor 1	Disable / Enable	State of sensor 1
		Sensor 2	Disable / Enable	State of sensor 2
		Sensor 3	Disable / Enable	State of sensor 3
		Sensor 4	Disable / Enable	State of sensor 4
		Sensor 5	Disable / Enable	State of sensor 5
		Sensor 6	Disable / Enable	State of sensor 6
		Section no. (Sensor 1)	1…32	Number of sections in which sensor 1 is placed
		Section no. (Sensor 2)	1…32	Number of sections in which sensor 2 is placed
		Section no. (Sensor 3)	1…32	Number of sections in which sensor 3 is placed
		Section no. (Sensor 4)	1…32	Number of sections in which sensor 4 is placed
		Section no. (Sensor 5)	1…32	Number of sections in which sensor 5 is placed
…		Section no. (Sensor 6)	1…32	Number of sections in which sensor 6 is placed
	…	…	…	…
	Module 32			
		Type	ARC-DMOD-3SL / ARC-DMOD-6NTFS	Type of 31st sensor`s module
		Section no. (Module)	1…32	Number of sections in which module is placed
		Sensor 1	Disable / Enable	State of sensor 1

Root	Subfolder	Parameter	Range	Description
		Sensor 2	Disable / Enable	State of sensor 2
		Sensor 3	Disable / Enable	State of sensor 3
		Sensor 4	Disable / Enable	State of sensor 4
		Sensor 5	Disable / Enable	State of sensor 5
		Sensor 6	Disable / Enable	State of sensor 6
		Section no. (Sensor 1)	1…32	Number of sections in which sensor 1 is placed
		Section no. (Sensor 2)	1…32	Number of sections in which sensor 2 is placed
		Section no. (Sensor 3)	1…32	Number of sections in which sensor 3 is placed
		Section no. (Sensor 4)	1…32	Number of sections in which sensor 4 is placed
		Section no. (Sensor 5)	1…32	Number of sections in which sensor 5 is placed
		Section no. (Sensor 6)	1…32	Number of sections in which sensor 6 is placed
iCOM				
		Display 1	None / ARC-MAIN-HMI	Connected display on iCOM
		Timeout screen saver	60…3600 s	After this time display turns off
IGNITION PORT				
		Tripping module	None / ARC-TMOD-1QD	Connected Tripping module on IGNITION PORT
		Section no. (Tripping module)	1…32	Number of sections in which Tripping module is placed
		Section no. (ARC-AT)	1…32	Number of sections in which ARC-AT device is placed
MASTERLINK				
		MASTERLINK	Disable / Enable	State of MASTERLINK function
		Address	1...8	Master module address on MASTERLINK
		Number of masters	2...8	Number of master modules connected on MASTERLINK
		Topology	Line / Ring	Master link network topology
		Trip activation zone 1	Enable / Disable	Zone 1 trip signal on MASTERLINK
		Trip activation zone 2	Enable / Disable	Zone 2 trip signal on MASTERLINK
		Trip activation zone 3	Enable / Disable	Zone 3 trip signal on MASTERLINK
		Trip activation zone 4	Enable / Disable	Zone 4 trip signal on MASTERLINK
		Trip activation zone 5	Enable / Disable	Zone 5 trip signal on MASTERLINK
		Trip activation zone 6	Enable / Disable	Zone 6 trip signal on MASTERLINK
		Trip activation zone 7	Enable / Disable	Zone 7 trip signal on MASTERLINK
		Trip activation zone 8	Enable / Disable	Zone 8 trip signal on MASTERLINK
CURRENT MEAS.				
		Criteria di/dt	Disable / Enable	State of protection criteria di/dt
		Limit I>>	0.5…5.0 x In	Setting for short circuit (multiple of nominal current)
NOMINALS				
		Nominal frequency	50Hz / 60Hz	Nominal frequency
		VT - Primary	1…999999 V	Primary side value of voltage transformer
		VT - Secondary	1…800 V	Secondary side value of voltage transformer
		CT - Primary	1…65535 A	Primary side value of current transformer
		CT - Secondary	1A / 5A	Secondary side value of current transformer
USER PROT. MODE				
		Security	Disable / Enable	Enables user protected operation mode
		Password	10000…99999	Password for user protected operation mode
		Timeout	60…65535 s	Timeout for staying in the user protected operation mode

Table 3.5: Extended system – UPF parameters

Events & Alarms

The Master MAIN firmware checks its peripherals, flags from all modules on the INTERLINK, iCOM, Ignition port and MASTERLINK. If an error or trip is encountered, then the according event will be set. Furthermore, the on-board watchdog is used for the self-monitoring of the entire system. Alarms are events which require user acknowledgment (ACK is "YES" in table below). An Alarm disappears only if it is acknowledged and the trigger condition is false. The alarms are saved non-volatile, so in case of loss of supply voltage the active alarms are not lost. After return of supply voltage all previous active alarms will be restored. If TRIP alarm is restored, then the output relays will be activated again, but NOT the ignition command to the quenching device.

For details about the impact of events on master LEDs and relays please find the table below:

Prefix	Number	Text	Description	ACK	Relay TRIP 1
	1	RESTART	System starting.	NO	OPEN
	3	START ADDRESSING	Addressing process started.	NO	-
E	4	ADDRESSING ERROR	Error detected in addressing process.	YES	-
	5	ADDRESSING OK	Addressing process finished successfully.	NO	-
E	6	FLASH ACCESS ERROR	Serial flash memory error detected.	YES	-
	8	START INITIALIZATION	Initialization process started.	NO	-
E	9	PARAMETERIZATION ERROR	Error while parameterization process.	YES	-
	10	PARAMETERIZATION OK	The parameterization process is completed successfully.	NO	-
	11	INITIALIZATION FINISHED	Initialization process finished.	NO	-
	12	START NORMAL OPERATION MODE	Entering into normal operation mode.	NO	-
T	13	TRIP	Arc protection trip detected.	YES	CLOSED
E	14	WD RESET	On chip watchdog reset happened.	YES	-
E	15	ADC ERROR	ADC error detected.	YES	-
E	16	DAC ERROR	DAC error detected.	YES	-
E	17	PARAMETER ERROR	Parameter error detected.(parameter missing or over range)	YES	-
E	18	SENSOR WIRE FAULT	Sensor wire fault detected.	YES	-
E	19	SENSOR CONSTELLATION ERROR	Unexpected sensor detected.	YES	-
E	20	INTERLINK ERROR	INTERLINK communication error. (CAN bus error)	YES	-
E	21	INTERLINK CONSTELLATION ERROR	INTERLINK module missing or unexpected module detected.	YES	-
E	22	INTERLINK COMPATIBILITY ERROR	INTERLINK compatibility error.	YES	-
E	24	UPF ERROR	User parameter file (UPF) missing or corrupted.	YES	-
E	25	MPF ERROR	Manufacture parameter file (MPF) missing or corrupted.	YES	-
	26	PARAMETER CHANGED	Parameter change detected.	NO	-
	27	USER MODE	Entering into user mode.	NO	-
	28	PROTECTED MODE	Entering into password protected mode.	NO	-
	29	MANUFACTURER MODE	Entering into manufacturer mode.	NO	-
E	30	ICOM ERROR	iCOM communication error. (CAN bus error).	YES	-

Relay TRIP 2	Relay TRIP 3	Relay Trip alarm	Relay Watchdog	LED System	LED TRIP	LED RUN[9]	LED TRIP[10]	IGNITION PIN
OPEN	OPEN	OPEN	OPEN	OFF	OFF	OFF	OFF	RESET
-	-	-	-	-	-	-	-	-
-	-	-	OPEN	Red / 2Hz	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	OPEN	Red / 2Hz	-	-	-	-
-	-	-	-	Orange / 2Hz	-	-	-	-
-	-	-	OPEN	Red / 2Hz	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	CLOSED	Green / 1Hz	-	Green / 1Hz	-	-
CLOSED	CLOSED	CLOSED	-	Green / 1Hz	Red	OFF	Red	SET
-	-	-	OPEN	Red / 2Hz	-	-	-	-
-	-	-	OPEN	Red / 2Hz	-	-	-	-
-	-	-	OPEN	Red / 2Hz	-	-	-	-
-	-	-	OPEN	Red / 2Hz	-	-	-	-
-	-	-	OPEN	Red / 2Hz	-	-	-	-
-	-	-	OPEN	Red / 2Hz	-	-	-	-
-	-	-	OPEN	Red / 2Hz	-	-	-	-
-	-	-	OPEN	Red / 2Hz	-	-	-	-
-	-	-	OPEN	Red / 2Hz	-	-	-	-
-	-	-	OPEN	Red / 2Hz	-	-	-	-
-	-	-	OPEN	Red / 2Hz	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	OPEN	Red / 2Hz	-	-	-	-

Extended system – Events & Alarms

Prefix	Number	Text	Description	ACK	Relay TRIP 1
E	31	ICOM CONSTELLATION ERROR	iCOM unit missing or unexpected unit detected.	YES	-
E	32	ICOM COMPATIBILITY ERROR	iCOM compatibility error.	YES	-
E	33	IGNITION WIRE FAULT 1	Ignition port wire fault 1 error detected.	YES	-
E	34	IGNITION WIRE FAULT 2	Ignition port wire fault 2 error detected.	YES	-
E	35	IGNITION VOLTAGE ERROR 1	Ignition port voltage level 1 error.	YES	-
E	36	IGNITION VOLTAGE ERROR 2	Ignition port voltage level 2 error.	YES	-
E	37	MASTERLINK ERROR	MASTERLINK communication error.	YES	-
E	38	MASTER CONSTELLATION ERROR	Master missing on the MASTERLINK.	YES	-
E	39	MASTERLINK COMPATIBILITY ERROR	MASTERLINK compatibility error.	YES	-
E	40	MASTER ADDRESS CONFLICT	Address conflict detected on the MASTERLINK.	YES	-
E	41	MAC ADDRESS CONFLICT	MASTERLINK: MAC address conflict detected.	YES	-
	42	PORT 1 LINK ESTABLISHED	MASTERLINK port 1 link established.	NO	-
	43	PORT 2 LINK ESTABLISHED	MASTERLINK port 2 link established.	NO	-
	44	CURRENT di/dt	di/dt limit exceeded.	NO	-
	46	LIGHT DETECTION	Sensor detected light.	NO	-
E	47	FAULTY LIGHT DETECTION	Too long light detection (>10s).	YES	-
E	48	OVERHEAT	Master module overheat. Temperature is too high.	YES	-
E	49	DISPLAY ADDRESS CONFLICT	Display address conflict detected on iCOM.	YES	-
E	50	GU: WD RESET	On chip watchdog reset happened.	YES	-
E	51	GU: FLASH ERROR	Access to flash memory fails.	YES	-
E	52	GU: PARAMETER ERROR	Parameter file missing or corrupted on the HMI.	YES	-
E	53	ALARM LIST OVERFLOW	There is no more space for alarms in the Alarm list.	YES	-
T	54	ZONE TRIP	Arc protection trip detected by another master on the masterlink	YES	CLOSED
E	55	SENSOR SHORT CIRCUIT	Sensor short circuit detected	YES	-

Table 3.6: Extended system – Events & Alarm

Relay TRIP 2	Relay TRIP 3	Relay Trip alarm	Relay Watchdog	LED System	LED TRIP	LED RUN[9]	LED TRIP[10]	IGNITION PIN
-	-	-	OPEN	Red / 2Hz	-	-	-	-
-	-	-	OPEN	Red / 2Hz	-	-	-	-
-	-	-	OPEN	Red / 2Hz	-	OFF	-	-
-	-	-	OPEN	Red / 2Hz	-	OFF	-	-
-	-	-	OPEN	Red / 2Hz	-	OFF	-	-
-	-	-	OPEN	Red / 2Hz	-	OFF	-	-
-	-	-	OPEN	Red / 2Hz	-	-	-	-
-	-	-	OPEN	Red / 2Hz	-	-	-	-
-	-	-	OPEN	Red / 2Hz	-	-	-	-
-	-	-	OPEN	Red / 2Hz	-	-	-	-
-	-	-	OPEN	Red / 2Hz	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	OPEN	Red / 2Hz	-	-	-	-
-	-	-	OPEN	Red / 2Hz	-	-	-	-
-	-	-	OPEN	Red / 2Hz	-	-	-	-
-	-	-	OPEN	Red / 2Hz	-	-	-	-
-	-	-	OPEN	Red / 2Hz	-	-	-	-
-	-	-	OPEN	Red / 2Hz	-	-	-	-
-	-	-	OPEN	Red / 2Hz	-	-	-	-
CLOSED	CLOSED	CLOSED	-	Green / 1Hz	RED	OFF	RED	SET
-	-	-	OPEN	Red / 2Hz	-	-	-	-

Troubleshooting alarms

Alarm	Text	Trigger	Solution
E.04	Addressing error	INTERLINK	Check if all INTERLINK cables are connected properly and the RJ45 terminator on the last module has been placed on OUT. Restart the system and try to acknowledge the alarm.
E.06	Flash access error	Internal hardware of master module	Restart the system and try to acknowledge the alarm. If not possible please contact the manufacturer.
E.09	Parameterization error	INTERLINK	Check if all INTERLINK cables are connected properly, restart the system and try to acknowledge the alarm. Tip: Do not disconnect any INTERLINK cable while initialization process (SYSTEM LED blinking orange), because it can produce this alarm
E.14	WD reset	Internal hardware of master module or a connected module	Restart the system and try to acknowledge the alarm. If not possible please contact the manufacturer.
E.15	ADC error	Internal hardware of master module or a connected module	Restart the system and try to acknowledge the alarm. If not possible please contact the manufacturer
E.16	DAC error	Internal hardware of master module or a connected module	Restart the system and try to acknowledge the alarm. If not possible please contact the manufacturer.
E.17	Parameter error	INTERLINK	Check if all INTERLINK cables are connected properly, restart the system and try to acknowledge the alarm.
E.18	Sensor wire fault	ARC-DMOD-3SL module (CH1-3) A sensor wire fault will be detected when configured sensor is disconnected more than 5s. It can be also detected in case when sensor is damaged, broken or wrong type.	Check if the sensor is connected properly and try to acknowledge the alarm. In this case the sensor must be replaced with a new one and the alarm can be acknowledged.
E.19	Sensor constellation error	ARC-DMOD-3SL module (CH1-3) Unexpected sensor has been detected. Sensor is connected on a position where it should not be connected. Position: M.xx – xx = module number S.yy – yy = sensor number	Disconnect the issued sensor and try to acknowledge the alarm.
E.20	INTERLINK error	INTERLINK communication interface	Check if all INTERLINK cables are connected properly and the RJ45 terminator on the last module has been placed on OUT. Restart the system and try to acknowledge the alarm.
E.21	INTERLINK constellation error	INTERLINK module missing or unexpected module detected. Wrong module type. Example: Point sensor module is connected instead of line sensor.	Check if all INTERLINK cables are connected properly and the number/type of parameterized modules is correct. Exchange the wrong device type or disconnect the added module, restart the system and try to acknowledge the alarm.
E.22	INTERLINK compatibility error	INTERLINK version of a module is not compatible with version supported by master.	Replace the module with compatible firmware version.
E.24	UPF error	Software Master MAIN User parameter file (UPF) missing or corrupted. Also, it will be detected on each new produced Master MAIN which is not yet configured.	Upload the UPF file from a parameter tool to the Master MAIN. The system will restart. Then try to acknowledge the alarm.
E.25	MPF error	Internal software of master module	Restart the system and try to acknowledge the alarm. If not possible please contact the manufacturer.
E.30	iCOM error	iCOM communication interface	Check if the iCOM cable is connected properly and the RJ45 terminator on the external HMI has been placed on OUT. Restart the system and try to acknowledge the alarm
E.31	iCOM constellation error	iCOM HMI missing or unexpected HMI detected.	Check parameter P3049 and connect or disconnect HMI accordingly.
E.32	iCOM compatibility error	iCOM version of the HMI is not compatible with version supported by master.	Replace the HMI with compatible firmware version.
E.33	IGNITION wire fault 1	Tripping module detects wire fault error on circuit L1/L2. Possible reasons: -Quenching Device (QD) disconnected -QD has already tripped – wire burned -QD is not functional – wire damaged	Connect the functional QD and try to acknowledge the alarm. Tip: Be sure that the power supply is connected to the Tripping module

Alarm	Text	Trigger	Solution
E.34	IGNITION wire fault 2	Tripping module detects wire fault error on circuit L2/L3. Possible reasons: -Quenching Device (QD) disconnected -QD has already tripped – wire burned -QD is not functional – wire damaged	Connect the functional QD and try to acknowledge the alarm. Tip: Be sure that the power supply is connected to the Tripping module
E.35	IGNITION voltage error 1	Tripping module detects too low voltage level on the capacitor which should burn the wire L1/L2 when trip occurs. Possible reasons: -The internal capacitor is damaged	Try to acknowledge the alarm without any additional action. Tip: Be sure that the power supply is connected to the Tripping module.
E.36	IGNITION voltage error 2	Tripping module detects too low voltage level on the capacitor which should burn the wire L2/L3 when trip occurs. Possible reasons: -The internal capacitor is damaged	Try to acknowledge the alarm without any additional action. Tip: Be sure that the power supply is connected to the Tripping module.
E.37	MASTERLINK error	MASTERLINK communication interface	Check if the MASTERLINK cables are connected properly(Ring/Line topology).
E.38	MASTER constellation error	MASTERLINK - missing or unexpected master module detected.	Check parameters P3193-P3195 and connect or disconnect masters accordingly.
		MASTERLINK - network topology Example: Parameterized Ring but connected Line topology. Or opposite.	Connect all required Ethernet cables for the desired network topology (P3196). Tip: Check do all connected master modules have the same network topology parameter.
E.39	MASTERLINK compatibility error	MASTERLINK - inconsistency of firmware version within topology.	Replace the non compatible master with correct firmware version.
E.40	MASTER address conflict	MASTERLINK - two master modules have the same address in parameter P3194.	Adjust the addresses in parameter P3194 to unique values.
E.41	MAC address conflict	Internal software of master module	Restart the system and try to acknowledge the alarm. If not possible please contact the manufacturer.
E.47	Faulty light detection	ARC-DMOD-3SL module (CH1-3) Too long light detection (>10s).	Ensure that no external light source is interfering the system (e.g. Direct sunlight).
E.48	Overheat	Master module overheat. The internal temperature is too high	Check if the module environment is according to the specification. When everything is in line try to acknowledge the alarm.
E.49	Display address conflict	Display address conflict detected on iCOM	Check if all connected ARC-MAIN-HMI have an individual iCOM address set by DIP-switches on the back of the device.
E.50	GU: WD reset	Internal hardware of external HMI	Restart the system and try to acknowledge the alarm. If not possible please contact the manufacturer.
E.51	GU: Flash error	Internal hardware of external HMI	Restart the system and try to acknowledge the alarm. If not possible please contact the manufacturer.
E.52	GU: Parameter error	HMI has detected an internal parameter error (parameter missing or corrupted).	Restart master and HMI and try to acknowledge the alarm.
E.53	Alarm list overflow	Master module There is no more space for alarms in the Alarm list. Info: The alarm list can store up to 100 alarms	All active alarms must be acknowledged and then it will be possible to acknowledge alarm “E.53”.
T.54	Zone trip	An arc protection trip has been detected by another extended master from MASTERLINK.	The alarm can be acknowledged as soon as trip/arc source disappears and T.13 is acknowledged on the source master on MASTERLINK. It can be also acknowledged if source master is disconnected from MASTERLINK.
E.55	Sensor short circuit	It will be detected in case when sensor is damaged or broken.	Check if the sensor is properly connected and try to acknowledge the alarm. If it repeats, the sensor has to be replaced with the correct one and the alarm can be acknowledged.

Table 3.7: Extended system – Troubleshooting alarms

Normal operation mode

After initialization process, the system enters normal operation mode.

In the normal operation mode, the master executes two parallel tasks:

1. System supervision

2. Arc detection

System supervision

In normal operation mode the master checks cyclic itself and the presence of all configured modules and all connected devices. If an error is detected, then the appropriate system error event and watchdog relay will be activated. For details see list of "3.11 Events & Alarms".Acknowledgment of system error is possible only if error source is deactivated. After acknowledging of all detected system errors, the watchdog relay output will be deactivated again.

Arc detection

There are two settable trip conditions:

- Light detection
- Light detection AND current criteria di/dt

The light detection is the obligatory criteria. The user can set di/dt as additional criteria for arc detection.

If the Detection module detects an arc by light, then this information is sent immediately to the Master MAIN. The Master MAIN checks, if parameterized, additional required current criteria. When all conditions for arc detection are fulfilled the master will activate the TRIP outputs. When current criteria di/dt is enabled, also the ignition command to the Tripping module (if configured) will be sent.

The TRIP event must be acknowledged by user via ACK-button on device or by display (optional). The relay outputs will be deactivated after acknowledging immediately

Files

There are 4 system files in the Extended system:

- General Info File (GIF)
- User Parameter File (UPF)
- Event Log File (ELF)
- Parameter Change Log (PCL)

General Info File (GIF)

The GIF provides information about hardware, firmware and files. User can see GIF on the Info page of external HMI display or in the parameter tool.

Note: Especially for retrofit business it's important to document and know the relevant firmware status of the individual system components. All components like ARC-MAIN-3G, ARC-MAIN-HMI, ARC-DMOD-3SL, and ARC-DMOD-6NTFS as well as the APPT version (software) have to be on the same firmware revision to run smoothly.

User Parameter File (UPF)

The UPF contains all user parameters. User can see UPF in the parameter section on the external HMI display or in the parameter tool.

Event Log File (ELF)

Every event is captured by Event logger and stored into ELF file. Maximal number of events which can be stored is 1000. User can see event log on the external HMI display, or to download ELF file from parameter tool.

Parameter Change Log (PCL)

Every parameter change is captured by Parameter change log and stored into PCL file. Maximal number of parameter changes which can be stored is 100. User can see parameter change log on the external HMI display, or to download PCL file from parameter tool.

Operation modes (Security)

Extended system supports two operation modes:

- User mode (default)
- User protected mode (with password)

The operation mode can be changed from:

- Display module
- Parameter tool (APPT)

User mode

After initial power on the extended system is in user mode and all read and write functions for parameters, history and change logs are enabled. If Parameter "Security" (UPF/USER PROT. MODE/Security) is set to Enable, all write functions on the HMI display will be disabled for the User mode.

User protected mode

When Parameter "Security" (UPF/USER PROT. MODE/Security) is set to Enable the user can only change parameters and delete history and change logs with password.

Password is using PIN in the range from 10000-99999 (UPF/USER PROT. MODE/PIN). The timeout timer (UPF/USER PROT. MODE/Timeout) is reset after each user input after the set time (60…65535s).

The password can be always changed by APPT software.

Complex system with up to eight ARC-MAIN-3G Master units

The Complex system consists of 2-8 Extended systems connected over MASTERLINK interface. All features of the Extended system apply to the Complex system and the additional feature is sharing of the current criteria flag between connected Extended systems. In case of detected current criteria at minimum one Extended system, the current criteria flag occurs on this system and the flag will be immediately sent to other connected Extended systems over the MASTERLINK interface. For the Complex system, trip time is also <2 ms.

Note: Only Extended system which detects light and receives or detects itself the current criteria will switch into the TRIP state, including ignition module (if configured). The TRIP can also be shared on the MASTERLINK and will be configured with the zone definition.

Constellation

An example of Complex system is shown on the following picture.
The example shows connection of 3 Extended systems in an overall Complex system.

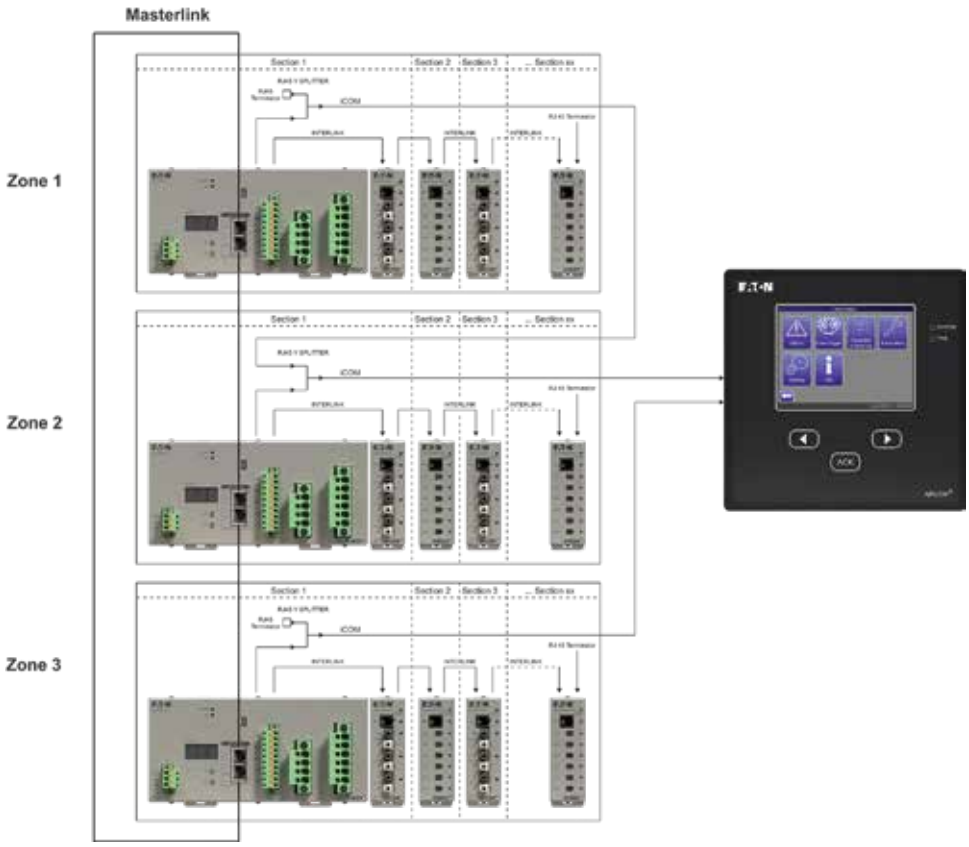


Figure 4.1 Complex system – Constellation

MASTERLINK

MASTERLINK supports up to 8 MAIN masters connected in the same network. It operates over Ethernet connection. Each master in the network must have different address. All MAIN masters can transmit and receive information. Main purpose of MASTERLINK is to exchange information about arc detection criteria between masters:

- Criteria di/dt
- Zone Trip

The topology of MASTERLINK can be set as Line or Ring network when Parameter Masterlink (UPF/MASTERLINK/MASTERLINK) is enabled.

Line
This is single Ethernet connection.

Figure 4.2 Complex system – MASTERLINK line topology

Ring
This is a redundant Ethernet connection. If a connection between two modules gets lost the system still operate.

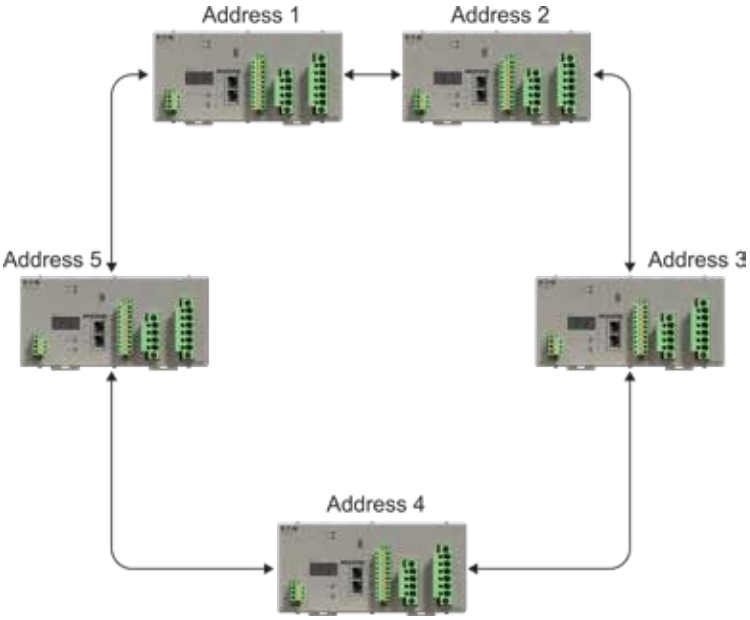


Figure 4.3 Complex system – MASTERLINK ring topology

Multiple MAIN masters with one or more HMIs

Within the complex system multiple master units can be connected together with one or more HMIs over the iCOM interface. The maximum number of devices on the iCOM is 8x ARC-MAIN-3G and theoretically 8x ARC-MAIN-HMI (if more than one HMI, each of them should have a unique address selected by the DIP-switches on the back side of the device).

MAIN master and HMI can be located anywhere on the iCOM bus, as long as the topology is in line with resistor at the beginning and the end of the line. Since the ARC-MAIN-3G has only one iCOM port, the brach-off adapter must be used.

The single port side will be connected to the master unit by using short piece of RJ45-cable. On the other two ports the iCOM-cable for the next connected module respectively the end of line resistor has to be plugged in.

Technical data

Tests and environmental conditions

Disturbance tests

Test	Standard & Test class	Test value
Emission		
Conducted	EN 55022:2010+AC:2011, Class A	150kHz – 30Mhz
Radiated	EN 55022:2010+AC:2011, Class A	30MHz – 6GHz
Immunity		
Electrostatic Discharge	EN 61000-4-2:2009, Class IV	8kV contact, 15kV air
Radiated Electromagnetic Field	EN 61000-4-3+A1+A2:2010, Class III	80MHz – 2.7GHz, 10V/m
Electrical Fast Transient / Burst	EN 61000-4-4:2012, Class IV	± 2/4kV, 5/50ns, 5kHz
Electrical Slow Transient / Surge	EN 61000-4-5:2006, Class IV*	± 2/4kV, 1.2/50µs
Conducted High Frequency	EN 61000-4-6:2014, Class III	0.15 – 80MHz, 10V
Power Frequency Magnetic Field	EN 61000-4-8:2010	100A/m(5min), 1000A/m(3s)
Pulsed Magnetic Field	EN 61000-4-9:2016	± 1kA/m, 8/20µs
Power Supply Variation and Failure	EN 61000-4-11:2004+A1:2007	0/10,40/200,70/500,0/5000(%/ms)
Voltage Alternative Component	EN 61000-4-17:1999+A2:2009	15% of supply voltage for 5min
Damped Oscillatory Wave	EN 61000-4-18:2007+A1:2010	± 1/2.5kV

*Class III: ARC-MAIN-HMI & TRIP relays with ± 2kV for line to earth, ± 1kV for power line

Table 5.1: Disturbance tests

Electrical safety tests

Test	Standard & Test class	Test value
Dielectric Withstand	IEC 60255-27:2013	2kV, 1min
Insulation Resistance	IEC 60255-27:2013	≥ 1000MΩ at test Level A and B
Impulse Voltage	IEC 60255-27:2013, Cat. III	± 1/6kV, 1.2/50µs, 0.5J
Protective Bonding	IEC 60255-27:2013	12VAC, 10A, <0.1Ω

Table 5.2: Electrical safety tests

Mechanical tests

Test	Standard & Test class	Test value
Shock Response, energized	EN 60068-2-27:2009, Class II	10g, 11ms, 3 shocks per direction
Shock Withstand, de-energized	EN 60068-2-27:2009, Class I	15g, 11ms, 3 shocks per direction
Bump Test, de-energized	EN 60068-2-27:2009, Class II	20g, 16ms, 1000 shocks per dir.
Vibration Sinusoidal Response	EN 60068-2-6:2008, Class II	1-35Hz, 1g in Z- and 2g in X-axis
Vibration Sinusoidal Endurance	EN 60068-2-6:2008, Class II	10-150Hz, 20m/s²

Table 5.3: Mechanical tests

Environmental tests

Test	Standard & Test class	Test value
Dry Heat Operational	EN 60068-2-2:2007, Test Be	70°C, 16h, On
Dry Heat Storage	EN 60068-2-2:2007, Test Bb	70°C, 16h, Off
Cold Test Operational	EN60068-2-1:2007, Test Ae	-40°C, 16h, On
Cold Storage	EN60068-2-1:2007, Test Ab	-40°C, 16h, Off
Damp Heat	EN60068-2-78:2013, Test Cab	40°C, 10d, Off, 93%RH
Cycling Temperature with Humidity	EN60068-2-30:2005, Test Db	25°C/40°C, 6d, Off, 93-97%RH
Change of Temperature	EN60068-2-14:2009, Test Nb	-40°C/+70°C, 50h, Off

Table 5.4: Environmental tests

Environmental conditions

Specified ambient service temperature range	-40…+70°C
Transport and storage temperature range	-40…+70°C
Relative humidity	Up to 95%

Table 5.5: Environmental conditions

ARC-LITE-3G

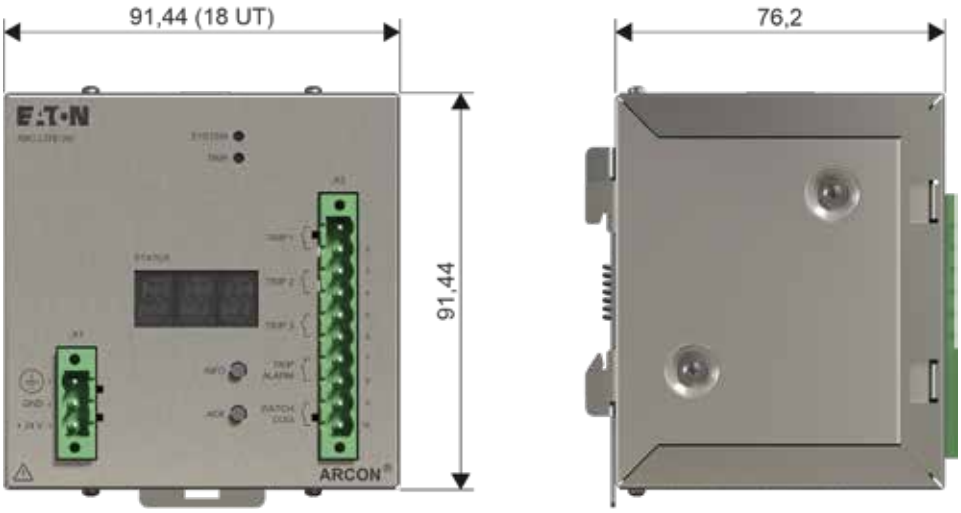


Figure 5.1 ARC-LITE-3G

General technical data

Description	Specification
Design	DIN rail TS35
Housing dimensions (W x H x D)	(193.04 x 91.44 x 76.20) mm
Weight	1.4kg
Installation position	Vertical
Protection type	IP20 (IEC 60529)

Table 5.6: General technical data

Inputs

Power supply

Description	Specification***
Power Supply***	24V DC ±20 %
Power consumption max	< 25W. depending on configuration
External fuse	4A; "T-type"
Name of connector	-X1
Cross section	0.5 mm² … 2.5 mm²

*** Due to safety reasons, it is not allowed to supply the ARCON-system by the internal power supply of the LV system – for a continuous and smooth operation of ARCON®, please use an independent and battery-buffered 24V DC power supply for all components with an external power supply interface. (connector -X1)

Table 5.7: Power supply

Push buttons

Description	Specification
INFO-Button	Get detailed information for an Error-Code shown in the STATUS-Display
ACK-Button	Acknowledge the currently displayed Error-Code shown in the STATUS-Display

Table 5.8: Push Buttons

Outputs

TRIP outputs

Designation	Description	Specification*
TRIP 1 TRIP 2 TRIP 3	Rated voltage (AC) Max. switching voltage Continuous current Max. making current	250V AC 300V AC/DC 16A AC/DC 16A AC/DC
	Max. breaking capacity (AC) Max. breaking capacity (DC) for 24V for 48V for 60V for 110V for 220V	2000VA with cos φ > 0,8 For resistive load 16A 1,2A 0,8A 0,4A 0,3A
	Contact switching times Max. turn-on delay Max. turn-off delay	 < 1ms 5ms
	Mechanical contact life-cycle	> 30 x 10^3 Operating cycles
	Name of connector	-X3
	Cross section	0.5 mm² … 2.5 mm²

* Environmental temperature: 25°C; humidity: non-condensing; device at steady operation at nominal values

Table 5.9: Trip outputs

Alarm & Watchdog

Designation	Description	Specification*
TRIP ALARM WATCHDOG	Rated voltage (AC) Max. switching voltage Continuous current Max. making current	250V AC 300V AC/DC 16A AC/DC 16A AC/DC
	Max. breaking capacity (AC) Max. breaking capacity (DC) for 24V for 48V for 60V for 110V for 220V	1500VA with cos φ > 0,8 For resistive load 6A 0,4A 0,3A 0,2A 0,15A
	Contact switching times Max. turn-on delay Max. turn-off delay	 12ms 5ms
	Mechanical contact life-cycle	5 x 10^3 Operating cycles
	Name of connector	-X3
	Cross section	0.5 mm² … 2.5 mm²

* Environmental temperature: 25°C; humidity: non-condensing; device at steady operation at nominal values

Table 5.10: Alarm & Watchdog

Indication LEDs

Designation	Color	Specification
SYSTEM	Green (1Hz)	Normal operation mode
	Orange (2Hz)	Initialisation process started
TRIP	Red (2Hz)	Error occurred, see Error code table and/or STATUS Display for detailed information
	Red (steady)	ARC-Protection TRIP detected

Table 5.11: Indications LEDs

Status display

Designation	Color	Specification
STATUS	Off	Normal operation mode
	e.g. "E.18"	Error code, see error code table for detailed information

Table 5.12: Status display

Communication

Data protocol	Description	Specification*	
INTERLINK	OUT	Interface:	RJ45 with ARC-CC.. cable
		Location:	top of housing
		Terminals:	"OUT" (INTERLINK to the next connected ARCON 3G module)*
		Transmission distance:	max. 100m
		Max. no. of modules connected to INTERLINK	31 pcs.

* For failure-free operation use the included RJ45 terminator at the last INTERLINK connected module

Table 5.13: Communication

ARC-MAIN-3G

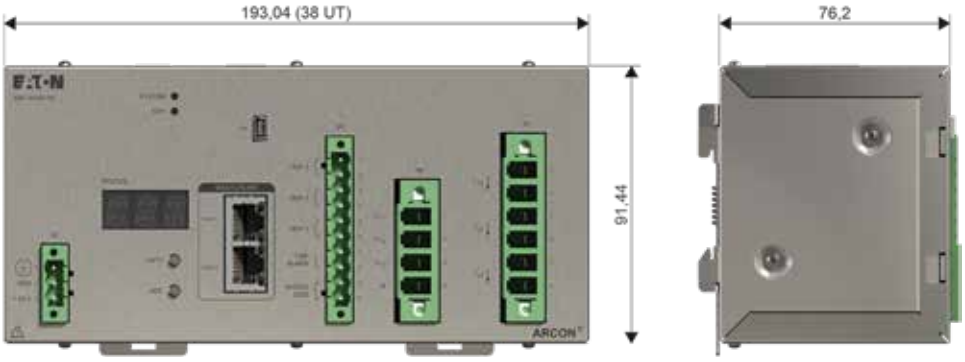


Figure 5.2 ARC-MAIN-3G

General technical data

Description	Specification
Design	DIN rail TS35
Housing dimensions (W x H x D)	(193.04 x 91.44 x 76.20) mm
Weight	1.4kg
Installation position	Vertical
Protection type	IP20 (IEC 60529)

Table 5.14: General technical data

Inputs

Power supply

Description	Specification***
Power Supply***	24V DC ±20 %
Power consumption max	< 25W. depending on configuration
External fuse	4A; "T-type"
Name of connector	-X1
Cross section	0.5 mm² … 2.5 mm²

***Due to safety reasons, it is not allowed to supply the ARCON-system by the internal power supply of the LV system – for a continuous and smooth operation of ARCON®, please use an independent and battery-buffered 24V DC power supply for all components with an external power supply interface. (connector -X1)

Table 5.15: Power supply

Push buttons

Description	Specification
INFO-Button	Get detailed information for an Error-Code shown in the STATUS-Display
ACK-Button	Acknowledge the currently displayed Error-Code shown in the STATUS-Display

Table 5.16: Push Buttons

Current measurement

Designation	Description	Specification*
Current measurement CT1	Nominal current Nominal frequency Meas. Range Accuracy Temperature influence (0...60°C)	1A** or 5A 50Hz / 60Hz 0…6x IN ≤ 1% Deviation: ≤ 1% IN
	Load per phase: for 1A for 5A	 approx.: 0.1VA approx.: 0.4VA
	AC overcurrent proof: 5x IN 10 x IN 20 x IN 50 x IN	 continuous up to 10s up to 1s For 10ms (half-oscillation)
	Name of connector	-X7
	Cross section	2.5 mm² … 6.0 mm²

* Environmental temperature: 25°C; humidity: non-condensing; device at steady operation at nominal values

**When using CTs with secondary level of 1A, up to 2 current transformers of the same type with identical characteristics can be connected in parallel to the current measurement input CT1.
This means that redundant incomers can be monitored on a main busbar section with just one ARC-MAIN-3G.
The "X7" terminal must be connected using a double wire end sleeve.

Table 5.17: Current measurement

Voltage measurement

Designation	Description	Specification*
Voltage measurement PT1	Nominal voltage Nominal frequency Impulse voltage (Cat.III) Meas. Range Accuracy Temperature influence (0...60°C)	100V / 110V / 400V / 690V 50Hz / 60Hz 8 kV 0…800V AC ≤ 1% Deviation: ≤ 1% UN
	Load per phase: for 100V for 400V for 690V	 approx.: 0.1VA approx.: 0.4VA approx.: 1.0VA
	AC overvoltage proof: for 800V for 2kV	 continuous up to 1s
	Name of connector	-X6
	Cross section	1.0 mm² … 6.0 mm²

* Environmental temperature: 25°C; humidity: non-condensing; device at steady operation at nominal values

Table 5.18: Voltage measurement

Outputs

TRIP outputs

Designation	Description	Specification*
TRIP 1 TRIP 2 TRIP 3	Rated voltage (AC) Max. switching voltage Continuous current Max. making current	250V AC 300V AC/DC 16A AC/DC 16A AC/DC
	Max. breaking capacity (AC) Max. breaking capacity (DC) for 24V for 48V for 60V for 110V for 220V	2000VA with cos φ > 0,8 For resistive load 16A 1,2A 0,8A 0,4A 0,3A
	Contact switching times Max. turn-on delay Max. turn-off delay	 < 1ms 5ms
	Mechanical contact life-cycle	> 30 x 10^3 Operating cycles
	Name of connector	-X3
	Cross section	0.5 mm² … 2.5 mm²

* Environmental temperature: 25°C; humidity: non-condensing; device at steady operation at nominal values

Table 5.19: Trip Outputs

Alarm & Watchdog

Designation	Description	Specification*
TRIP ALARM WATCHDOG	Rated voltage (AC) Max. switching voltage Continuous current Max. making current	250V AC 300V AC/DC 16A AC/DC 16A AC/DC
	Max. breaking capacity (AC) Max. breaking capacity (DC) for 24V for 48V for 60V for 110V for 220V	1500VA with cos φ > 0,8 For resistive load 6A 0,4A 0,3A 0,2A 0,15A
	Contact switching times Max. turn-on delay Max. turn-off delay	 12ms 5ms
	Mechanical contact life-cycle	5 x 10^3 Operating cycles
	Name of connector	-X3
	Cross section	0.5 mm² … 2.5 mm²

* Environmental temperature: 25°C; humidity: non-condensing; device at steady operation at nominal values

Table 5.20: Alarm & Watchdog

Indication LEDs

Designation	Color	Specification
SYSTEM	Green (1Hz)	Normal operation mode
	Orange (2Hz)	Initialisation process started
TRIP	Red (2Hz)	Error occurred, see Error code table and/or STATUS Display for detailed information
	Red (steady)	ARC-Protection TRIP detected

Table 5.21: Indication LEDs

Status display

Designation	Color	Specification
STATUS	Off	Normal operation mode
	e.g. “E.18”	Error code, see error code table for detailed information

Table 5.22: Status display

Communication

INTERLINK

Data protocol	Description	Specification*	
INTERLINK	OUT	Interface:	RJ45 with ARC-CC.. cable
		Location:	top of housing
		Terminals:	"OUT" (INTERLINK to the next connected ARCON 3G module)*
		Transmission distance:	max. 100m
		Max. no. of modules connected to INTERLINK	31 pcs.

* For failure-free operation use the included RJ45 terminator at the last INTERLINK connected module

Table 5.23: INTERLINK

MASTERLINK

Data protocol	Description	Specification*	
MASTERLINK	IN/OUT	Interface:	RJ45 with ARC-CC.. cable
		Location:	front of housing
		Terminals:	"IN" & "OUT" (MASTERLINK to the next connected ARCON 3G Master module)
		Transmission distance:	max. 100m
		Max. no. of modules connected to MASTERLINK	8 pcs.

Table 5.24: MASTERLINK

iCOM

Data protocol	Description	Specification	
iCOM	OUT**	Interface:	RJ45 with ARC-CC.. cable
		Location:	top of housing
		Terminals:	"IN" (iCOM to the previous connected module)* "OUT" (iCOM to the next connected module)*
		Transmission distance:	max. 100m
		Max. no. of modules connected to iCOM	8x ARC-MAIN-3G and, 8x ARC-MAIN-HMI

* for failure-free operation use the included RJ45 terminators at the first and last connected module (can be either HMI or Master Main)
** to realize IN/OUT connection interfaces please use the branch-off adapter which is part of Master Main delivery content

Table 5.25: iCOM

IGNITION PORT

Data protocol	Description	Specification	
IGNITION PORT	OUT	Interface:	RJ45 with ARC-CC.. cable
		Location:	top of housing
		Terminals:	"OUT" (IGNITION PORT to the next connected Tripping module)
		Transmission distance:	max. 10m
		Max. no. of modules connected to IGNITION PORT	1 pc.

⚠ IGNITION PORT must be connected properly, otherwise devices can get damaged! Only necessary, if an external quenching device is considered for arc mitigation.

Table 5.26: IGNITION PORT

USB interface

Data protocol	Description	Specification	
USB	OUT	Interface:	mini USB (standard)
		Location:	front of housing
		Terminals:	"USB"
		Transmission distance:	max. 5m
		Max. no. of modules connected to USB	1 pc.

Table 5.27: USB interface

ARC-DMOD-3SL

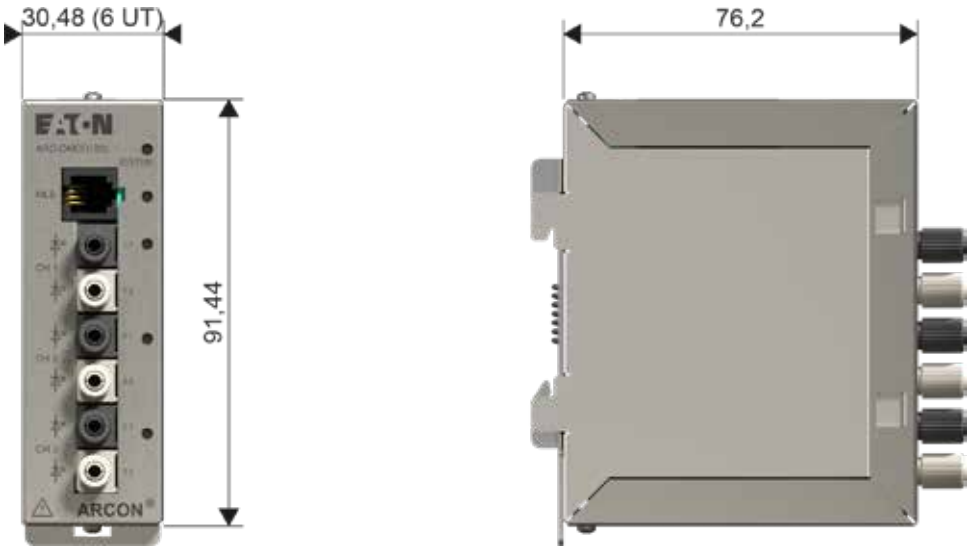


Figure 5.3 ARC-DMOD-3SL

General technical data

Description	Specification
Design	DIN rail TS35
Housing dimensions (W x H x D)	(30.48 x 91.44 x 76.20) mm
Weight	0.3kg
Installation position	Vertical
Protection type	IP20 (IEC 60529)

Table 5.28: General technical data

Inputs

Line Sensor (ARC-SL)

Description	Specification
Max. no. of sensors	3 pcs. (CH1, CH2, CH3)
Type of sensor	ARC-SL… (3 x 2 in-connections for Ferrule Ø 2.2mm)
Interface:	
Receiver	SFH250V
transmitter	SFH757V
Name of connector	CH1, CH2, CH3

Table 5.29: Line Sensor

Mobile light sensor (MLS)

Description	Specification
Max. no. of MLS	1 pc.
Type of MLS	ARC-NTFS-MLS
Interface:	RJ9 4p4c
Name of connector	MLS

Table 5.30: Mobile light sensor (MLS)

Indication LEDs

Description	Color	Specification
SYSTEM	Green (1Hz)	Normal operation mode
	Orange (2Hz)	Configuration or addressing process started or Error occurred or Sensor Wire fault
MLS	Green (steady)	Normal operation mode, MLS sensor connected
	Red (steady)	Light detected
CH1 CH2 CH3	Green (steady)	Normal operation mode, Line sensor connected
	Orange (steady)	Sensor wire fault
	Red (steady)	Light detected

Table 5.31: Indication LEDs

Communication

INTERLINK

Data protocol	Description	Specification	
INTERLINK	IN / OUT	Interface:	RJ45 with ARC-CC.. cable
		Location:	top of housing
		Terminals:	"IN" (INTERLINK coming from previous ARCON 3G module) "OUT" (INTERLINK to the next connected ARCON 3G module)*
		Transmission distance:	max. 100m
		Max. no. of modules connected to INTERLINK	31 pcs.

* For failure-free operation use the included RJ45 terminator at the last INTERLINK connected module

Table 5.32: INTERLINK

ARC-DMOD-6NTFS

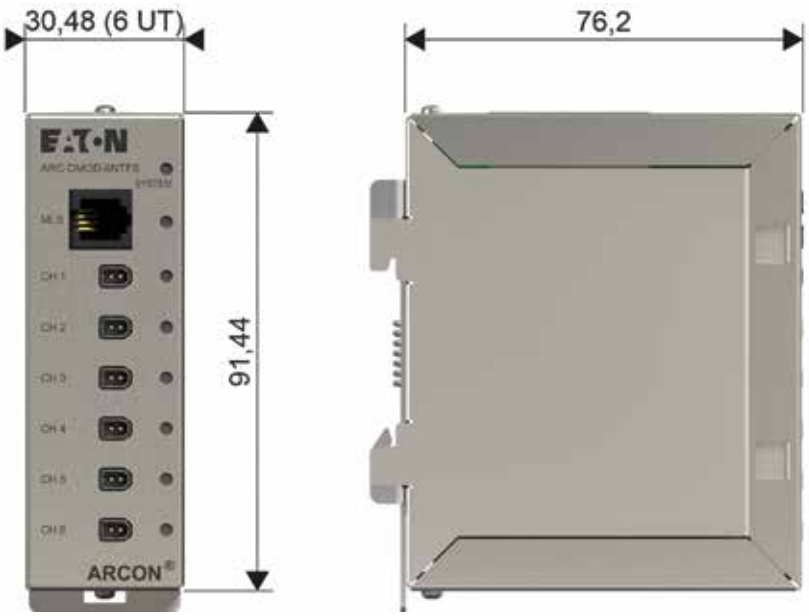


Figure 5.4 ARC-DMOD-6NTFS

General technical data

Description	Specification
Design	DIN rail TS35
Housing dimensions (W x H x D)	(30.48 x 91.44 x 76.20) mm
Weight	0.3kg
Installation position	Vertical
Protection type	IP20 (IEC 60529)

Table 5.33: General technical data

Inputs

Point Sensor (ARC-NTFS)

Description	Specification
Max. no. of sensors	6 pcs. (CH1, CH2, CH3, CH4, CH5, CH6)
Type of sensor	ARC-NTFS-3M / ARC-NTFS-6M (Nuisance Tripping Free Sensor)
Interface:	Single Pair Ethernet (SPE)
Name of connector	CH1, CH2, CH3, CH4, CH5, CH6

Table 5.34: Point Sensor

Mobile light sensor (MLS)

Description	Specification
Max. no. of MLS	1 pc.
Type of MLS	ARC-NTFS-MLS
Interface:	RJ9 4p4c
Name of connector	MLS

Table 5.35: Mobile light sensor (MLS)

Indication LEDs

Description	Color	Specification
SYSTEM	Green (1Hz)	Normal operation mode
	Orange (2Hz)	Configuration or addressing process started or Error occurred or Sensor wire fault / short circuit
MLS	Green (steady)	Normal operation mode, MLS sensor connected
	Red (steady)	Light detected
CH1 CH2 CH3 CH4 CH5 CH6	Green (steady)	Normal operation mode, Point sensor connected
	Orange (steady)	Sensor wire fault / short circuit
	Red (steady)	Light detected

Table 5.36: Indication LEDs

Communication

INTERLINK

Data protocol	Description	Specification	
INTERLINK	IN / OUT	Interface:	RJ45 with ARC-CC.. cable
		Location:	top of housing
		Terminals:	"IN" (INTERLINK coming from previous ARCON 3G module) "OUT" (INTERLINK to the next connected ARCON 3G module)*
		Transmission distance:	max. 100m
		Max. no. of modules connected to INTERLINK	31 pcs.

* For failure-free operation use the included RJ45 terminator at the last INTERLINK connected module

Table 5.37: INTERLINK

ARC-TMOD-1QD

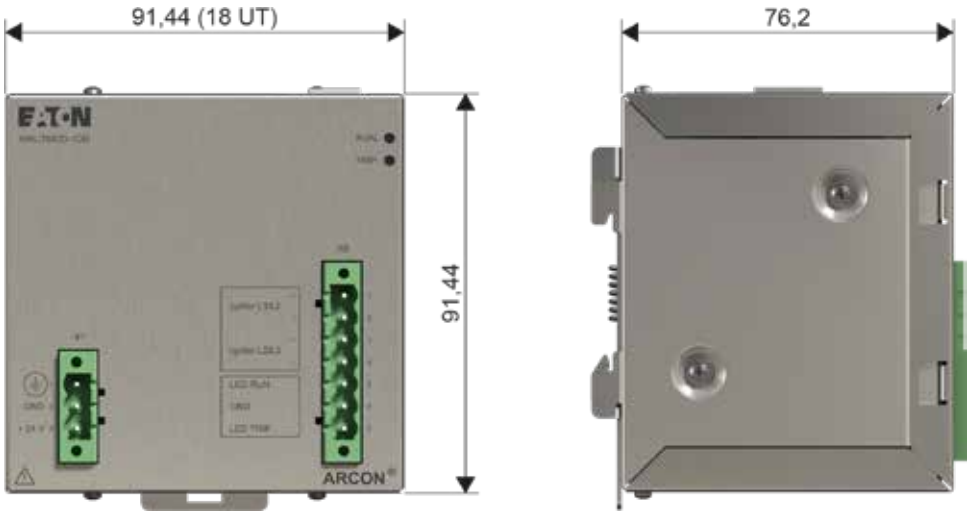


Figure 5.5 ARC-TMOD-1QD

General technical data

Description	Specification
Design	DIN rail TS35
Housing dimensions (W x H x D)	(91.44 x 91.44 x 76.20) mm
Weight	0.5kg
Installation position	Vertical
Protection type	IP20 (IEC 60529)

Table 5.38: General technical data

Inputs

Power supply

Description	Specification***
Power Supply***	24V DC ±20%
Power consumption max	< 2W
External fuse	4A; "T-type"
Name of connector	-X1
Cross section	0.5 mm² … 2.5 mm²

***Due to safety reasons, it is not allowed to supply the ARCON-system by the internal power supply of the LV system – for a continuous and smooth operation of ARCON®, please use an independent and battery-buffered 24V DC power supply for all components with an external power supply interface. (connector -X1)

Table 5.39: Power supply

Outputs

Ignition circuits

Designation	Description	Specification
"L1/L2" "L2/L3"	Rated Ignition voltage	30V DC
	Ignition current: t = 0 ms t = 10 ms	 ≥ 9.5A ≥ 5.0A
	Current for wire fault supervision	10mA
	Max. turn-on delay	< 1µs
	Name of connector	-X8
"LED RUN" "GND" "LED TRIP"	Functionality	For external indication LEDs (same indication as ARC-AT)
	Output voltage	depends on LED-type
	Output current, max.	15 mA
	Name of connector	-X8
	Transmission distance	max. 3 m

Table 5.40: Ignition circuits

Indication LEDs

Designation	Color	Specification
RUN	Green (1Hz)	Normal operation mode
TRIP	Red (steady)	ARC-Protection TRIP detected

Table 5.41: Indication LEDs

Communication

IGNITION PORT

Data protocol	Description	Specification	
IGNITION PORT	IN	Interface:	RJ45 with ARC-CC.. cable
		Location:	top of housing
		Terminals:	"OUT" (IGNITION PORT to the next connected Tripping module)
		Transmission distance:	max. 10m
		Max. no. of modules connected to IGNITION PORT	1 pc.

Table 5.42: IGNITION PORT

ARC-MAIN-HMI

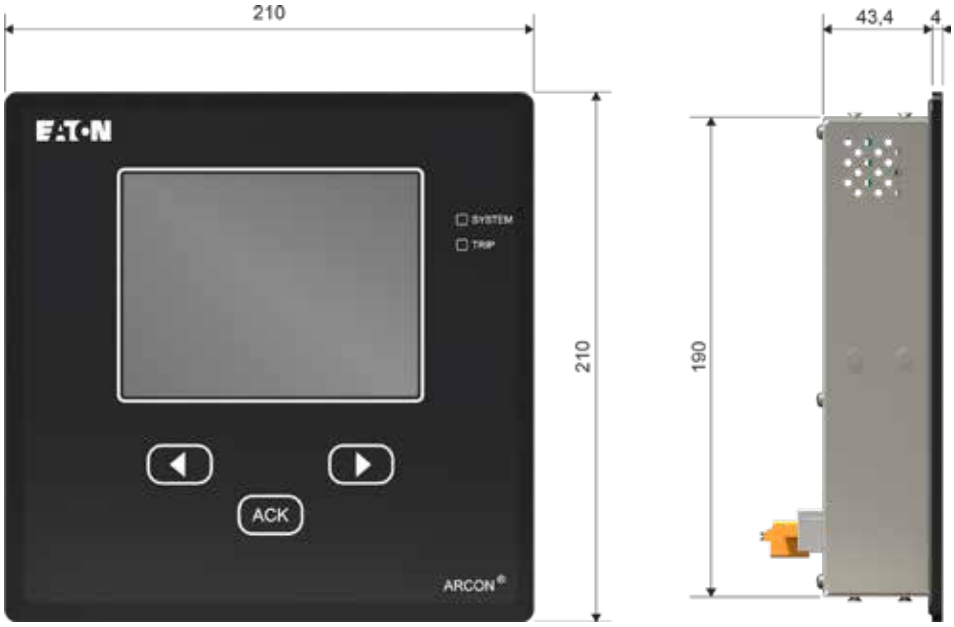


Figure 5.6 ARC-MAIN-HMI

General technical data

Description	Specification
Design	Panel mounting
Housing dimensions (W x H x D)	(210 x 210 x 80) mm
Cut-out dimensions (W x H x D)	192 x 192 x 80
Weight	1.4kg
Installation position	Vertical
Protection type	IP55 (front)

Table 5.43: General technical data

Inputs

Power supply

Description	Specification***
Power Supply***	24V DC ±20 %
Power consumption max	< 2.5W
External fuse	4A; "T-type"
Name of connector	-X1
Cross section	0.5 mm² … 2.5 mm²

***Due to safety reasons, it is not allowed to supply the ARCON-system by the internal power supply of the LV system – for a continuous and smooth operation of ARCON®, please use an independent and battery-buffered 24V DC power supply for all components with an external power supply interface. (connector -X1)

Table 5.44: Power supply

Communication

iCOM

Data protocol	Description	Specification	
iCOM	IN/OUT	Interface:	RJ45 with ARC-CC.. cable
		Location:	backside
		Terminals:	"IN" (iCOM to the previous connected module)* "OUT" (iCOM to the next connected module)*
		Transmission distance:	max. 100m
		Max. no. of connected modules	8x ARC-MAIN-3G and 8x ARC-MAIN-HMI
DIP-switch		Address setting for multiple HMIs from 0-7 (binary)	

*for failure-free operation use the included RJ45 terminators at the first and last connected module (can be either HMI or Master Main)

Table 5.45: iCOM

ARC-AT-T/3G

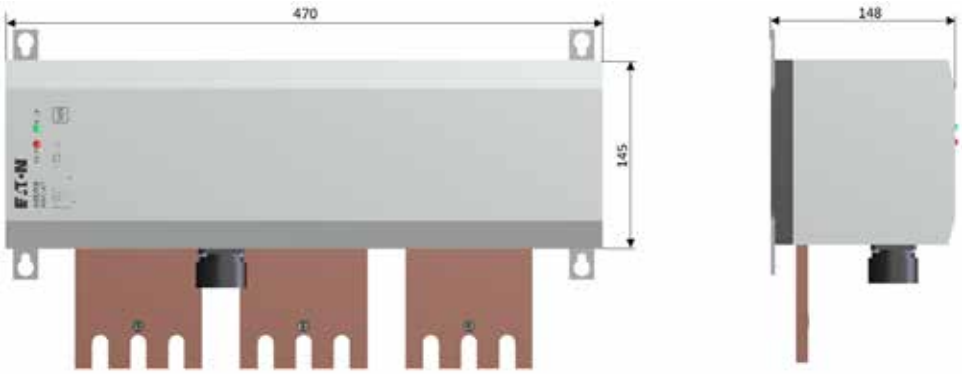


Figure 5.7 ARC-AT-T/3G

General technical data

Description	Specification
Design	Mounting plate fixation with main busbar connection (3-phase)
Housing dimensions (W x H x D)	(470 x 145 x 148) mm
Weight	~ 16.5 kg
Installation position	Horizontal / vertical
Standards	Arc Quenching Device (AQD) acc.to IEC 60947-9-1:2019
Rated operational voltage (Ue)	690 V
Rated impulse withstand voltage (Uimp)	8 kV
Rated frequency (f)	50 Hz / 60 Hz
Rated short-time withstand current (Icw)	85 kA /1 s 105 kA / 0.5 s
Maximum operating time	0.45 ms
Maximum voltage drop in the low-impedance state	20 V (peak)
Rated insulation voltage (Ui)	1000 V
Pollution degree	3
Overvoltage category	III
Value of tightening torque for the terminals	50 Nm (M10 screws)
Maximum permissible temperature of the AQD main circuits terminals	+75°C
Ambient temperature in the vicinity of the AQD (during operation)	-40°C … +70°C

Table 5.46: General technical data

Inputs

Ignition circuits

Description	Specification
Rated Ignition voltage	30V DC
Ignition current:	
t = 0 ms	≥ 9.5A
t = 10 ms	≥ 5.0A
Current for wire fault supervision	10mA
Max. turn-on delay	< 1µs
Interface	Amphenol C16-3 male
Cable length	max. 3 m

Table 5.47: Ignition circuits

Outputs

Indication LEDs

Designation	Color	Specification
RUN	Green (1Hz)	Normal operation mode
TRIP	Red (steady)	ARC-Protection TRIP detected

Table 5.48: Indication LEDs

Glossary

Term	Explanation
ACK	Acknowledgment
ADC	Analog to Digital Converter
APPT	Arc Protection Parameter Tool
AQD	Arc Quenching Device
ARC-NTFS	Nuisance Tripping Free Sensor (Point Sensor)
ARC-SL	Fiber Optic Line Sensor
BO	Binary Output
CAN	Controller Area Network
CF	Configuration File
DAC	Digital to Analog Converter
DIN	German Institute for Standardization (Deutsches Institut für Normung)
DST	Daylight Saving Time
ELF	Event Log File
FW	Firmware
GIF	General Info File
HMI	Human Machine Interface
iCOM	Communication bus between master and display unit
IGNITON PORT	Interface to the Tripping module
INTERLINK	Communication bus between master and Detection modules
LED	Light Emitting Diode
MASTERLINK	Communication bus between masters in the complex system
MLS	Mobile Light Sensor ARC-NTFS-MLS
MPF	Manufacturer Parameter File
PCL	Parameter Change Log
RJ45	Registered Jack 45
RMS	Root Mean Square
USB	Universal Serial Bus
UTC	Coordinated Universal Time
WD	Watch Dog
WF	Wire Fault

Table 6.1: Glossary

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Notes:

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