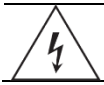
GEPA

ARG Series
Battery Charger with Battery Group

User Guide

- Read this document before montage and wiring.
- Make sure device is not energized before wiring. Do not touch terminals while device is energized.
- Montage and wiring must be done according to document by qualified person/people.
- Use dry cloth to clean. Do not use chemicals that may lead deformation or corrosion.
- Warranty is valid for 2 years from invoice date, batteries are excluded from warranty.
- Warranty will be violated under these conditions; unauthorized modifications or using inappropriate battery group with wrong parameterization.
- This device is intended for use in indoor and industrial environment.
- Manufacturer or sales company is not responsible of faults if user doesn't obey recommendations at the above.
- This is a Class A product. In a domestic environment, this product may cause radio interference, in which case the user may be required to take adequate measures.



Contact with high voltage (≥ 42.2V_{ACpeak} or ≥ 60 V_{DC}) may cause electrical shock and injury.

This product conforms to Low Voltage Directive (LVD) 2014/35/EU and Electromagnetic Compatibility (EMC) Directive 2014/30/EU.

Consult us for recycling or disposal of the device and batteries according to WEEE directive.

Manufacturer Contact Details

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Table of Contents

1. General

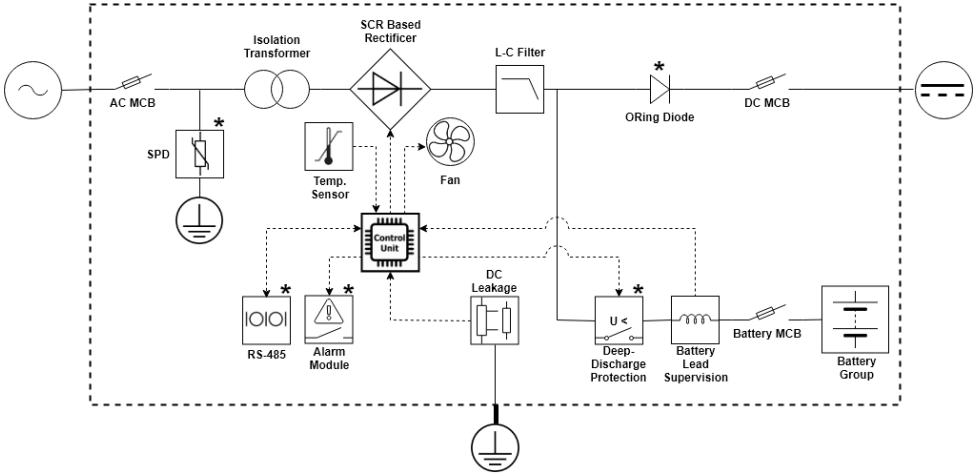
ARG Series Battery Charger with Battery Group is specifically designed to be used in power stations and substations. The device combines battery charger and battery group in one cabinet; provides a compact solution for space constraint facilities.

SCR based battery charger rectifies AC voltage and to supply DC supplied components and keep batteries charged. Charged battery group ensures DC supply continuity in case of power outage, also provides high current demands when battery charger may not be able to handle (ex: circuit breaker spring charging).

- Battery charger and battery group in one cabinet
- Microcontroller controlled SCR (thyristor) rectifier
- 24/48/110V voltage output and customizable current output and battery group capacity
- Wide input voltage tolerance
- Floating or equalizing charge
- Independent and adjustable battery charge and total system current output
- Electronic short-circuit protection at DC output
- Soft start
- MCB at 10kA breaking capacity at AC input, DC output(s) and battery output with auxiliary contacts
- DC leakage detection
- Fan forced ventilation
- Battery lead supervision
- Deep-discharge protection (standard at 24V)
- VRLA batteries with 10 – 15 years lifespan expectancy
- Easy access to battery group with drawer system (only 24V, 18/26Ah model)
- Audible and visual alarm announce
- HMI with legible 2.6” LCD
- Eliminates panel meters; input and output measurements are displayed on HMI
- Authorization with 4-digit password
- Alarm contact outputs with 14 different alarms (optional)
- Communication with Modbus RTU protocol via isolated RS-485 physical interface (optional)
- Surge protection devices for transient suppression (optional)

2. Functions

Simplified block schema of ARG Series Battery Charger with Battery Group is given at the below. '*' marked functions are optional.



2.1. Rectification

Microcontroller controlled 2-thyristor / 2-diode full bridge rectifier circuit and input isolation transformer is used for rectification.

DC load and battery charging is controlled separately. An L-C based low pass filter ensures low ripple on DC output. Electronic current limiting limits output at I_n, also protect the device by limiting current and minimizing voltage in case of short-circuit at output. Output voltage, total current and battery current limits are adjustable.

Cooling is ensured by proper passive cooling blocks and a digital temperature controlled fan. Fan is supplied from AC input and controlled by microcontroller according to digital temperature sensor measurement. Operating temperature is adjustable.

2.2. Battery Charging

Two charging modes are available. User is responsible to check battery specifications for floating and equalizing charge limits if battery group is not montaged and wired by manufacturer or built-in.

Float Charge

Float charge mode compensates battery self-discharge and keep battery fully charged at maximum capacity. Maximum charge current is 0.1C, ex. 2.6A for 26Ah, for most VRLA batteries.

Equalizing Charge

This mode brings all battery cells voltage at the same level at higher voltage by charging them with higher current. Equalizing charge might remove sulfation on plates, thus makes battery capacity fully available. Maximum charge current is 0.3C, ex. 7.8A for 26Ah, for most VRLA batteries.

Default limits (0.1C and 0.3C) are determined for VRLA batteries.
Refer to battery datasheet to verify maximum charge current limits.

2.3. Metering

The device control unit measures following parameters

- AC input voltage,
- AC input frequency,
- AC input current,
- DC output voltage,
- Total system output current,
- Battery charge current,
- In-cabinet temperature.

2.4. Alarm and Annunciation

14 different alarms are available. All alarms are shown on control unit screen and some are available as LEDs on control unit. An internal buzzer is available for local alarm annunciator.
Optional alarm module has NO contacts and LEDs for each alarm. Descriptions are given at the below:

- For DC leakage, see section '2.5.5. DC Leakage'.
- AC Loss will trigger if AC supply not applied or detected.
- AC High/Low will trigger if AC input voltage is out of preset limits.
- DC High/Low will trigger if DC output voltage is out of preset limits.
- For battery lead supervision or battery continuity, see section '2.5.3. Battery Lead Supervision'.
- Replace battery will trigger if battery capacity is under 50%. While AC is not present and load is supplied from battery group, control unit calculates battery group capacity according to Peukert's law. This device is intended to use with AGM or gel VRLA batteries, so coefficient is 1.1.
- Overload will trigger if total current output is limited at maximum current for 1 hour.
- Over-temperature will trigger if in-cabinet temperature is over preset limit.
- For fan fault, see section '2.5.2. Fan Fault Supervision'.
- Common alarm will trigger if any alarm condition described above occurs, except AC loss.

2.5. Supervising

Each supervising function triggers an alarm which will be shown on control unit screen or available on remote monitoring modules.

2.5.1. Temperature Supervision

If in-cabinet temperature (heating components in particular) reaches over preset value, over-temperature alarm will be triggered.

2.5.2. Fan Fault Supervision

Fan fault alarm will trigger if fan fails to operate.

2.5.3. Battery Lead Supervision

Battery charger continuously supervises its connection to battery group. In case of disconnection, device announces audible and visible alarm from control unit LED, LCD and related alarm contact output. Battery lead supervision is able to detect following faults:

- Corrosion or shedding occurs at battery plates during usage and it's unavoidable. Because of corrosion, plate may lose it conductance to battery lead. In series connected battery group even one plate loses connection, battery charger and battery group disconnects from system. In this case,

battery group doesn't able to get charge or provide power.
• If charger to battery group connection is faulty, broken cable or not properly connected multi-contact plug socket with models with drawers.

2.5.4. Deep Discharge Protection

If AC input is not present and battery group voltage drops to preset deep discharge voltage level, this module disconnects battery group from load to prevent unrecoverable deep discharge state.

Battery group is automatically reconnected to battery charger after AC input voltage is applied.

This feature is standard in ARG-24 and optional in ARG-110.

2.5.5. DC Leakage Supervising

DC leakage (+) or (-) alarms will trigger if 5 mA current measured between positive (+) or negative (-) terminals of battery for 1 s.

DC leakage detection circuit forms a connection between earth and DC output through resistance. DC leakage connections should be unplugged before insulation tests.

2.6. DC Source Mode

This mode is available for use the battery charger for laboratory purposes or similar. Output current limit is adjustable up-to 1.5 times of I_n.
Disconnect batteries before activating DC source mode.

2.7. Autonomous Battery Maintenance

Under normal conditions VRLA batteries doesn't need any maintenance. Battery group should be checked periodically in order to ensure batteries are available to service.
The device has two different autonomous battery maintenance methods.

2.7.1. TEDAŞ (Turkish Electricity Distribution Authority) Method

This method is not recommended in substation or power station applications.
If battery voltage drops to critical limit during discharge and power outage occurs, protection equipment may not be supplied adequately. This method is inactive by default. Use 'Equalize Timer Mode' instead of this maintenance program.

This maintenance program is applied periodically at definite time of day. Battery charger stops and load is only supplied from battery group. Battery group is discharged until preset voltage for allowed duration and then charged again. Setting parameters are at the below:

• *Annual Maintenance Quantity:* Period on yearly basis, ex. 4 means every 3 months.
• *Battery Discharge Voltage:* Battery group is discharged until voltage drops to preset voltage.
• *Maintenance Duration:* Maximum duration of maintenance in hours. Discharge process is cancelled if duration exceeds.
• *Maintenance Start Time:* Maintenance starts on preset time of day, preferably when power outage risk is lowest.

2.7.2. Equalize Timer Mode Method

Battery charger periodically applies equalizing charge for preset equalizing charge time to prevent sulfation on battery plates. This method is active by default.

2.8. Surge Protective Devices

Surge protective devices (SPD) are used as transient suppressers at AC input. SPDs will be installed before isolation transformer between L-PE and N-PE.

This module is optional.

Lightning protection shall be coordinated to make it effective; used SPDs are Class III according to IEC 61643-1 and not effective alone to protect devices in facility. Class I and Class II also shall be installed in coordination for enough protection. Refer to IEC 62305 for more information.

2.9. Redundant Operation

An ORing diode is installed at the DC output of battery chargers if redundant operation is required. One with higher DC output voltage will be primary and other will be secondary/backup. In case of fault in primary, secondary will supply load.

This feature is optional.

2.10. Remote Monitoring

Alarm module has 15 NO (Form A) contacts for 14 different alarms. Each alarm has status LED and clearly visible from front panel. Contact terminals are accessible from front side and isolated from other circuits. Following alarms are available:

- AC MCB switch off,
- DC or battery MCB switch off,
- DC (+) leakage,
- DC (-) leakage,
- AC loss,
- DC low,
- DC high,
- AC low,
- AC high,
- Battery lead supervision,
- Replace battery,
- Overload,
- Over temperature,
- Fan fault,
- Common alarm.

Common alarm is activated if any alarm condition occurs -except AC loss- and higher contact capacity than others. Without AC or DC supply voltage this contact is normally closed, when supply applied if there is no alarm, this contact changed to normally open.

Communication with Modbus RTU protocol via an isolated RS-485 physical interface is available. All measurements, alarms and settings are accessible. Register map is available on request.

These features are optional.

3. Commissioning

3.1. Montage & Wiring

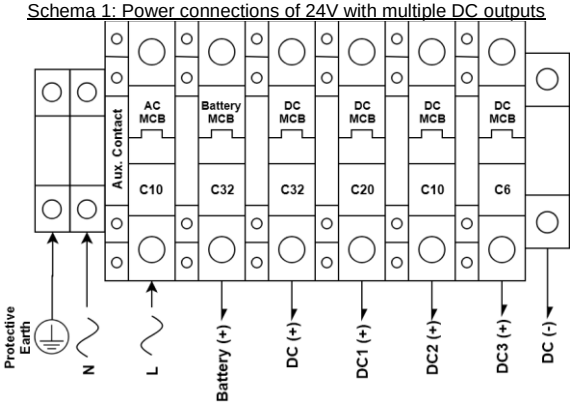
Avoid exposed to high humidity, dust, high ambient temperature location or high vibration. Allow at least 15 cm clearance on sides for proper ventilation. Place the device to a solid base. Relatively lighter models have bolt holes at the bottom to fix the device to floor, fix the cabinet to the ground with bolts.

The device has two cable entries, one on the side and one at the bottom of cabinet.

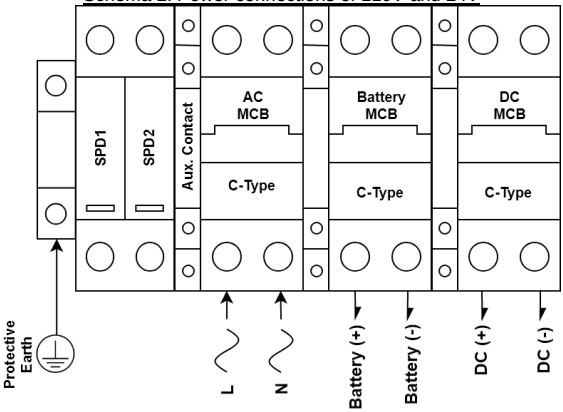
- Side entry which is next to MCBs and alarm module is easier to access.
- If bottom entry is preferred:
    - In models with drawers, there are no obstacles between terminals and entry or use cable spiral wrap as guide.
    - In models without drawers, use holes on battery shelves as cable guide.

Wiring schemas are given at the below. MCB I_n varies according to input and output current.

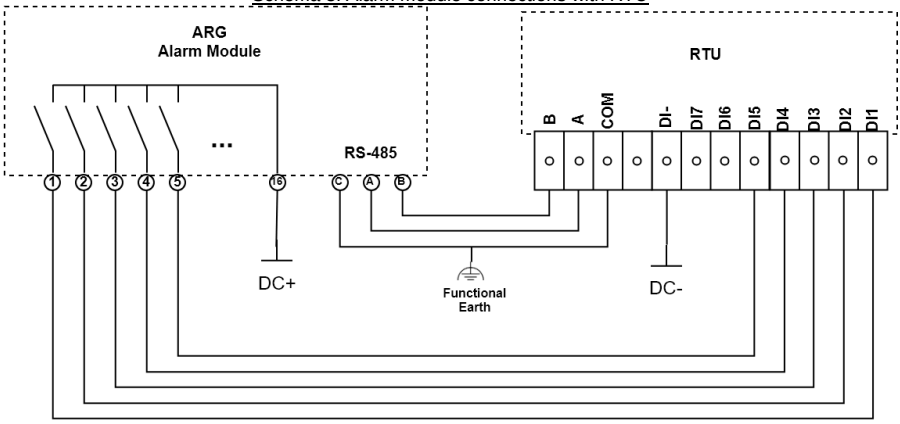
Schema 1: Power connections of 24V with multiple DC outputs



Schema 2: Power connections of 110V and 24V

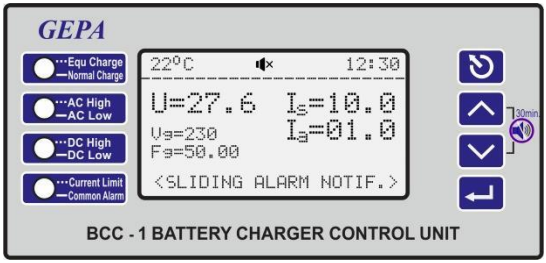


Schema 3: Alarm module connections with RTU



3.2. Monitoring and Settings

3.2.1. Default Screen



Default screen displays the following parameters:
- In-cabinet temperature,
- Mute symbol if buzzer is disabled,
- Fan symbol if operating,
- Time of day,
- AC input voltage (V_g), frequency (F_g),
- DC output voltage (U),
- Total current output (I_S),
- Battery charging current (I_a),
- Sliding alarm notifications.

Following alarms and status information is shown with LEDs:
- Charging mode LED is on and steady if floating or flashing if equalizing charge mode is active.
- AC High/Low and DC High/Low LEDs are; on and steady if over or flashing if under preset value. If both in preset limits LED is off.
- Bottom LED is on and steady if output current is limited and flashes if any of alarms is occurred. Check default screen to see which alarms are occurred.

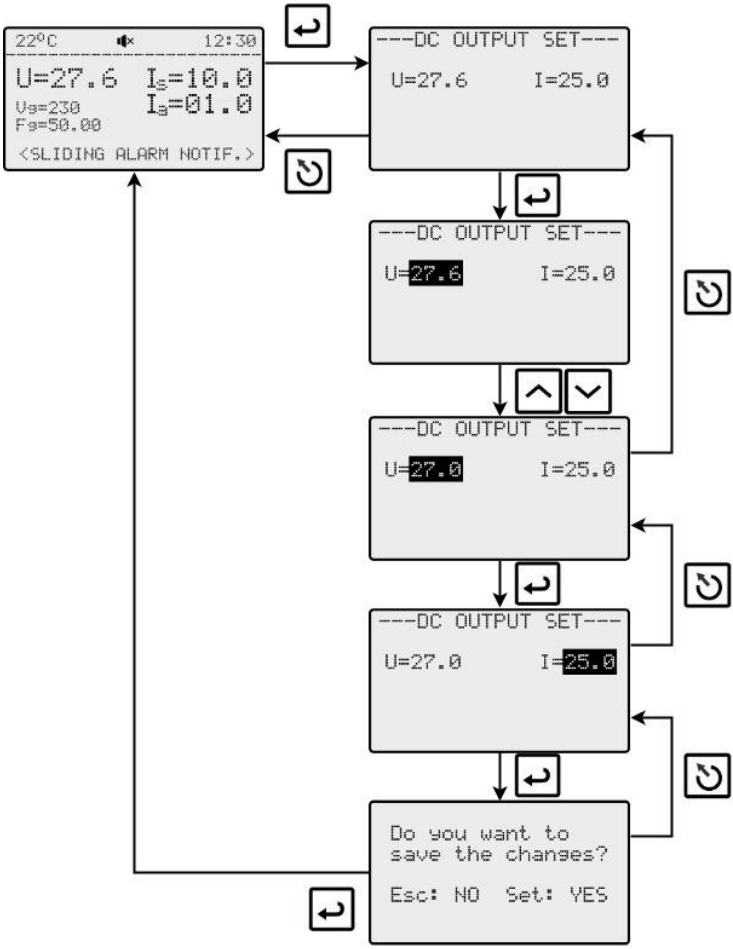
3.2.2. Muting Buzzer Temporarily

Press UP and DOWN buttons at the same time buttons to mute the buzzer for 30 min. Press again to unmute or control unit unmute itself after 30 min.

3.2.3. Editing Setting Parameters

This example describes how to edit ‘DC Output Voltage’ parameter; also applicable for editing other setting parameters.

1. On default screen press SET for Main Menu.
2. Press SET again to adjust any parameter on the screen. After pressing SET, cursor will be move onto ‘U’ parameter.
3. Use UP and DOWN buttons to adjust the parameter. To cancel press ESC. Press SET to move onto next parameter ‘I’.
4. Again, use UP and DOWN buttons to adjust the parameter or skip adjusting by pressing SET.
5. Verification dialog will be shown. Press SET to verify or ESC to revert the changes.



3.2.4. Setting Parameters

DC Output

Parameter	Description	Range	Step	Default
U	Output voltage for floating charge.	20.0 – 30.0 V for 24V 90 – 130 V for 110V	0.1 V for 24V 1 V for 110V	27.6 V 124 V
I	Output current limit for floating charge.	1.0 – I_n A	0.1A	I_n

Battery Charge Settings

Parameter	Description	Range	Step	Default
Battery Select	Charge limits are determined automatically by selecting used battery group.	7 … 100, Manual	-	-
Float U	Output voltage for floating charge.	20.0 – 30.0 V for 24V 90 – 130 V for 110V	0.1 V for 24V 1 V for 110V	27.6 V 124 V
Float I	Output current limit for floating charge.	0.1 – (0.1C) A 0.1 – I_n A for Manual	0.1A	(0.1C) A
Equal U	Output voltage for equalizing charge.	20.0 – 30.0 V for 24V 90 – 130 V for 110V	0.1 V for 24V 1 V for 110V	27.6 V 124 V
Equal I	Output current limit for equalizing charge.	0.1 – (0.3C) A 0.1 – I_n A for Manual	0.1A	(0.3C) A

Equalize Charge

Parameter	Description	Range	Step	Default
Duration	Duration of equalizing charge.	1 – 9 hrs	1 hr	1 hr
Status	Status of equalizing charge mode.	Active – Passive	-	Passive

DC Source Mode

Parameter	Description	Range	Step	Default
V_3	Voltage output for DC source mode.	20.0 – 30.0 V for 24V 90 – 130 V for 110V	0.1 V for 24V 1 V for 110V	27.6 V 124 V
I_3	Current output limit for DC source mode.	0.1 – I_n A	0.1A	I_n
Status	Status of DC source mode.	Active – Passive	-	Passive

Fan Control

Parameter	Description	Range	Step	Default
Temperature	Operating temperature of fan cooling.	20 – 99 ºC	1 ºC	35 ºC
Status	Status of fan control.	Active – Passive	-	Passive

Alarm Settings

Parameter	Description	Range	Step	Default
AC Under	Minimum AC input threshold for alarm.	150 – 210 V	1 V	190 V
AC Over	Maximum AC input threshold for alarm.	230 – 270 V	1 V	240 V
DC Under	Minimum DC output threshold for alarm.	18 – 25 V for 24V 81 – 112 V for 110V	1 V	20 V for 24V 90 V for 110V
DC Over	Maximum DC output threshold for alarm.	27 – 34 V for 24V 121 – 153 V for 110V	1 V	30 V for 24V 135 V for 110V
Over Temp	Over temperature alarm.	30 – 99 ºC	1 ºC	70 ºC

Common Settings

Parameter	Description	Range	Step	Default
Buzzer	Status of alarm buzzer.	Active – Passive	-	Active
Language	Control unit interface language.	Türkçe - English	-	Türkçe
Deep Discharge Threshold	Threshold of battery group disconnection from load.	18 – 27 V for 24V 82 – 123 V for 110V	1 V	20 V for 24V 90 V for 110V

Equalize Timer Mode

Parameter	Description	Range	Step	Default
Period	Period of periodic equalizing charge. Refer to “Equalize Charge” menu duration for duration.	1 – 9 hrs	1 hr	1 hr
Status	Status of periodic equalizing charge.	Active – Passive	-	Active

Battery Maintenance (TEDAŞ Maintenance Method)

Parameter	Description	Range	Step	Default
Annual Battery Maintenance Quantity	This parameter determines how many times this method will be applied.	1 – 6	1	4
Maintenance Voltage	Minimum battery voltage to stop discharge.	21 – 24 V for 24V 94 – 108 V for 110V	1 V	22 V for 24V 100 V for 110V
Maintenance Duration	Duration of maintenance method if battery voltage doesn’t drops under prior setting.	2 – 48 hrs	1 hr	48 hrs
Maintenance Start Time	Time of day to start maintenance.	HH:MM	-	00:30

Password Settings

Parameter	Description	Range	Step	Default
Password	4-digit password to prevent unauthorized access to control unit.	0 – 9999	1	0000
Status	Status of password authentication.	Active – Passive	-	Active

Date / Time Settings

Parameter	Description	Range	Step	Default
Date	In DD/MM/YY format.			
Time	In HH:MM format.			
DST Setting	Status of day light saving.	Active – Passive	-	Passive

4. Technical Specifications

		24V / 25A	110V / 25A
Input Voltage		230 V_{AC} or 120 V_{AC} (±%20)	230 V_{AC} or 120 V_{AC} (±%20)
Input Frequency		50 or 60 Hz (±%5)	50 or 60 Hz (±%5)
Input Current		5.25 A_{max}	27 A_{max}
Power Factor		0.82	0.66
Output Voltage	**Nominal**	27.6 V_{DC}	124 V_{DC}
	Range	20.0 – 30.0 V_{DC}	90 – 130 V_{DC}
	DC Source Mode	20.0 – 30.0 V_{DC}	90 – 130 V_{DC}
Output Current	**Nominal**	I_n	I_n
	Range	1.0 - I_n	1.0 - I_n
	DC Source Mode	1 – 1.5 I_n	1 – 1.5 I_n
Output Power		700 W	3200 W
Output Ripple		<5% (w/o battery)	<5% (w/o battery)
Output Filtering		L-C Filter	L-C Filter
Efficiency		≤%75	≤%81
Mini Circuit Breaker		Single or Double Pole, I_{CN}=10kA, C-Type	Double Pole, I_{CN}=10kA, C-Type
Cooling Method		Fan forced (AF)	
Operating Temperature		(-20) – (+55) °C	
Relative Humidity		< % 95 RH (without condensation)	
Pollution Degree		III	
Alarm Contacts		14 NO mechanical contact, 3A/30V_{DC} or 5A/250V_{AC}, 1385 VA / 90 W 1 NC mechanical contact, 5A/30V_{DC} or 10A/250V_{AC}, 2500 VA / 150 W 750 V_{RMS} breakdown between open contacts	
RS-485 Port		2 wire, isolated	
Insulation	**Independent Circuits**	AC Input – DC Output – Earth – Alarm Contacts – RS-485	
	Dielectric Withstand	2 kV_{AC} / 50 Hz, 1 min (all independent circuits, including SELV circuits)	
Reference Standard(s)		IEC 60146-1-1	

5. Order Code

ARG – 24 25 SD 26

- 24: Output Voltage: 24 / 48 / 110 V
- 25: Output Current: 5 … 40 A
- SD: Optional Features
  - S – Alarm Contact Outputs
  - H – RS-485 Communication
  - D – Deep-Discharge Protection
  - V – AC Surge Protective Device
  - P – Parallel ORing Diode
- 26: Battery Capacity: 18 … 150 Ah

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