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MAGNAVOLT

INSTRUCTION & OPERATING MANUAL

TYPE FKA480-12-6000
0 - 12VDC, 0 - 6000A, 72kW

Dimensions: 20” W x 73” H x 24” D
Weight: ~ 695 lbs

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MAGNAVOLT

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1 SAFETY INSTRUCTIONS

This product contains highly dangerous voltage that on contact can cause electric shock, burns or death.

This product is only intended for use as a power supply. The User Guide must be read **before** installation.

WARNING! Only allow qualified personnel to carry out installation according to the installation guide and local regulations.

WARNING! Only allow qualified personnel to carry out servicing or maintenance.

WARNING! Always disconnect the main AC supply in a safe manner before servicing/maintenance work is started. Work shall follow the service instruction in the attached technical description.

The power supply is only intended for professional use and must not be used in home or office environments.

1.1 Description of safety symbols

Warning, risk of electric shock!

Before operating the unit:
- Carefully read the manual.

Warning, risk of electric shock!

Before opening the unit:
- Isolate from the AC electrical supply.

Connection point for the protective ground.

1.2 Standards

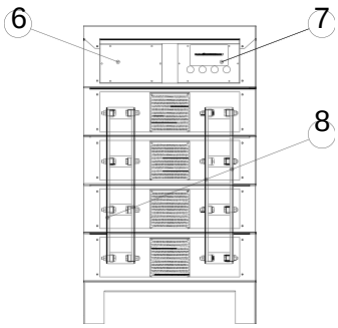
The standards or technical specifications apply:

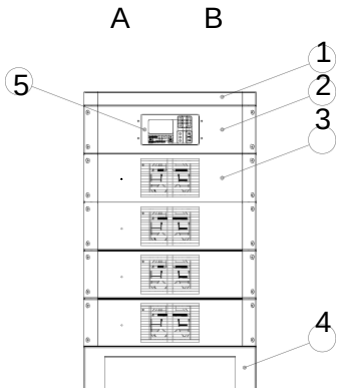
Electrical safety:	
EIC 50178	Electronic equipment for use in power installations
EMC Immunity:	
EIC 61000-6-2	Electromagnetic compatibility - Immunity for industrial equipment
EMC Emissions:	
EIC 61000-6-4	Electromagnetic compatibility - Generic immunity standard - Part 2: Industrial environment

The unit installed correctly does not disturb other equipment via conducted or radiated RF effects.

2 GENERAL

This modular designed power supply consisting of one control module and up to max. ten identical power modules. If more current or power is needed from an existing power supply, power modules can be added, up to a maximum of 10. Built in EMC filter meet EMC standards.

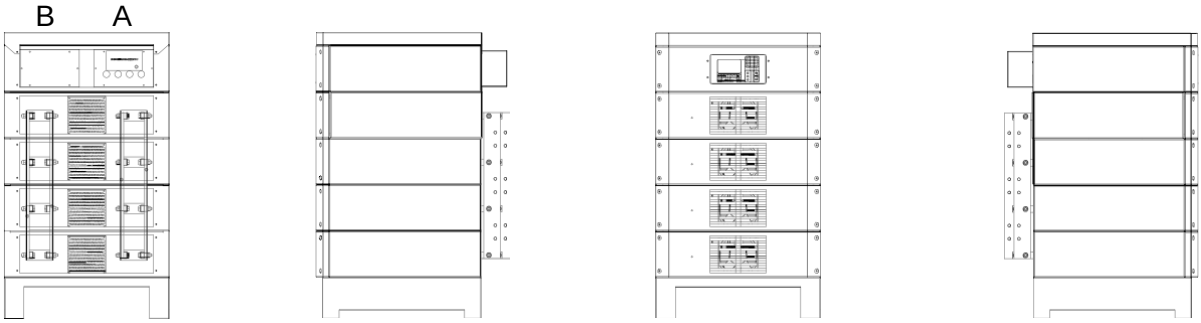




1 Cover
2 Control module
3 Power module
4 Base
5 Display with keys
6 AC Input connection
7 Remote control cable connection
8 DC output bus bars

Side A is to the left seen towards the front of the rectifier

Design



Unit with control module on top (standard configuration).

3 INSTALLATION GUIDE

3.1 ESSENTIAL ELECTRICAL KNOWLEDGE

Installation of the power supply may only be carried out by qualified personnel, i.e. trained electricians that have sufficient experience to avoid the dangers of electricity.

3.2. TRANSPORT & HANDLING

Attention ! The power supply is heavy when equipped with many modules. Use lifting equipment and secure the load when lifting. Serious personal injury and material damage can result should the unit be dropped.

Check that the equipment has not been damaged during transport.
Protect the unit against harsh treatment, vibrations and harmful substances.

The power supply can be lifted with a lift truck or with a sling / rope or with the optional lifting eye bolts.
If the power supply is lifted with a lifting sling or rope, you must check that the distance between the top of the rectifier and the lifting point is sufficient. Alternatively, a bar, that spreads the lifting sling above the rectifier, should be used.

NOTE! Take care to ensure that the sling / rope cannot slip off or that hooks can slip out of place during lifting.

Lifting with a sling / rope

A= min 6 Ft a= min 1.5 Ft

NOTE! U se a piece of wood (approx. 1.5” x 31” x 24”) for additional support and use a lifting yoke if possible. It may be necessary to increase the dimensions shown depending on the lifting capacity of the sling.

Lifting with optional eye bolts

Avoid this lifting method Use lifting yoke.

a = min 1.5 Ft

3.3 SET UP

3.3.1 General

The power supply is designed and manufactured to withstand the environment in a industrial facility. The components and modules have been treated to minimum the effects from the surrounding environment. The power supply is air-cooled and the cooling fans should be checked regularly and replaced when necessary.

The power supply can be expanded with power modules when the current / output needs to be increased..

3.3.2 Recommendations for installation

The maximum service life is obtained when the following is observed during installation:

- Installation in an area solely intended for electrical equipment .
  The environment in this area should be clean and dry (Max. relative humidity 85 %)
- The power supply should be protected from mechanical damage and sprayed water.

Obvious incorrect installation or operation will void the warranty.

3.3.3 Power supply location

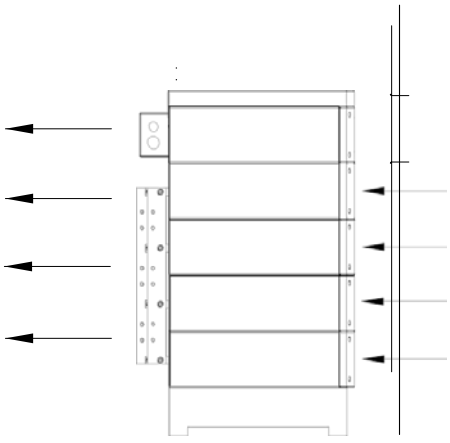
For service and maintenance power supply needs to be accessible at the back to connect cables to the load and to remove the power modules from the chassis when replacing modules. At the front a free space of at least 3 Ft is required to pull out the power modules, and for servicing.
It is recommended that clearance of 1.5 – 3 Ft is provided at the back of the power supply to provide access for load connections.

The power supply can be installed without the need to open the enclosure, only the cover plate over the connection terminals needs to be opened.

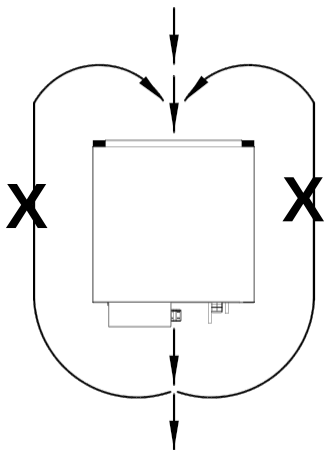
The following should be observed during installation:
Check both before and after installation that the power supply has not suffered any mechanical damage.

When damage has occurred, the manufacturer or local authorized distributor must be notified immediately. Repairs must be made before installation and commissioning. If this procedure is not followed the Warranty will be void.

The power supply has to have free access to air from the front and the air outlets at the back must not be blocked.
NOTE: The exhausted air must be able to freely depart from the power supply and **must not re-enter the air intake.**



Air flow



ATTENTION: Keep in mind the weight of the power supply. Appropriate lifting equipment must be used and the power supply must be well anchored so that it cannot tip and cause damage.

3.4 ELECTRICAL INSTALLATION

WARNING! Only allow qualified personnel to carry out servicing or maintenance.

WARNING! HIGH LEAKAGE CURRENT. The **protective ground** must **always** be connected in a reliable manner so that the power supply does not become live in the event of a fault. The earth conductor on the power supply 's terminal should be approximately 1” longer than the phase conductors.

CAUTION! Check that contact between the DC output bars and cables /bus bars is firm. This will keep bus the temperature on the DC output bus bars down. Bad / loose connections can cause the temperature to rise significantly. The maximal allowable temperature on the DC bus bars is 75C

3.4.1 AC Input data & connection

3-Phase AC Input voltage	Input Current (480VAC)	Input Current (480VAC -10%)	Connection area	Recommended Breaker per phase
480VAC ±10%	109 A	121 A	1.97 inch^2	125 A

WARNING! HIGH LEAKAGE CURRENT due to EMC components. **The power supply must always be connected to protective ground to prevent the power supply to become live in the event of a fault.** The ground conductor by the power supply 's terminals should be approximately 2” (50mm) longer than the phase conductors to ensure a proper earth connection.

NOTE: The power supply must be connected to a Y-connected transformer with a grounded zero point. (Voltage phase to zero point (ground) = voltage phase to phase/√3. This is the normal connection of a power distribution. The type of the ground fault breaker shall be a type B.

Power cable connection X1 is in the box to the left of the control module. Open the cover plate and connect the cable. It is possible to connect the cable from either end of the box.

The three phases are connected to the terminal A1:X1 on the control module and the protective ground to the ground stud next to the terminal A1:X1 on the control module. The unit is not phase sensitive. For recommended cable cross section ***observe local regulations for cables and cable sizes*.**

The control module consists of two Modules. AC connection is provided in the top module.

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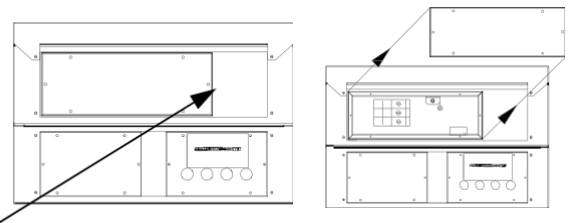
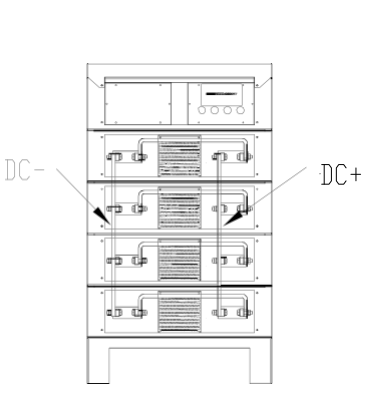


Hole diam. 2.5” (64mm) in the gable

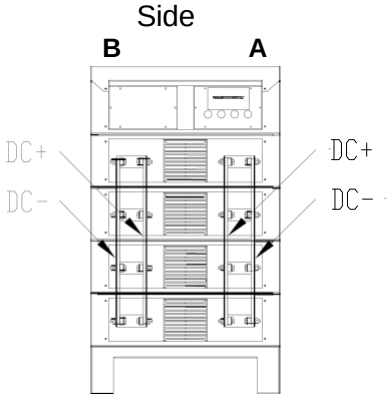
Built-in AC breaker on input side
This unit includes an AC breaker that cuts off the power supply to the power modules. The AC breaker is installed in the control module. The control system in the control module has a supply voltage, so that communication and/or manual operation are possible, even with the AC breaker switched OFF.

3.4.2 Load connection

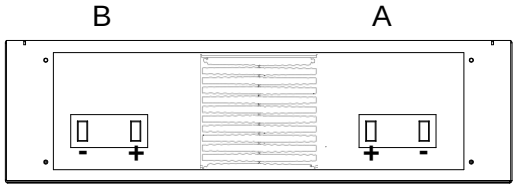
Make sure that that the contact between the output bus bars and cables / bus bars is tight since bad contacts can cause the temperature to rise significantly. The maximal allowable temperature on the DC bus bars is 75 °C



Series connection



parallel and dual connection

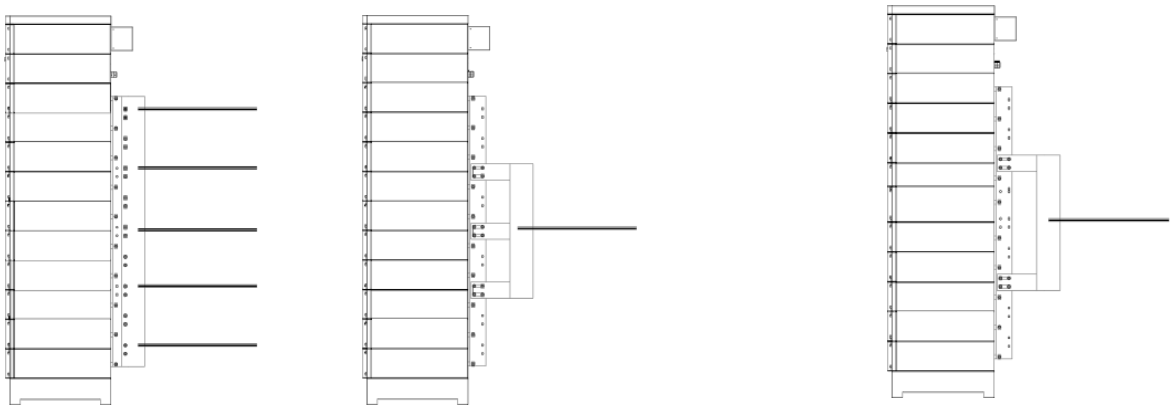


Connection of the DC conductors is made on the DC output bus bars by using cables or bus bars. For recommended cross sections of the DC cables / bus bars ***observe local regulations.***

Hole diameters in the DC bus bars are 0.35” (9 mm) and intended for 5/16” (M8) bolts. The load cable shall be **connected in the middle of the bus bar or evenly distributed along the interconnected bus bars**.
The two positive and two negative bus bars are interconnected. Connections **must not** be made at one end of the bus bar. If connection of the load takes place at one end of the interconnecting bus bar, the interconnected bus bar will be overloaded.

The power module halves can be connected in **series for double the rated output voltage and half the rated output current** or in **parallel with the max. rated output voltage and max. output current.**

NOTE: Check that contact between the DC output bus bars and cables /bus bars is tight. This will keep the temperature on the DC output bus bars down. Bad / loose connections can cause the temperature to rise significantly. The maximal allowable temperature on the DC bus bars is 75°C. The bus bar temperature is supervised and the power supply stops when the temperature is over limit.



Examples of power cable connections on DC output side

3.4.3 Emergency stop connection

External emergency stop

The emergency stop circuit breaks the control voltage to the AC breaker .To enable the AC breaker to be on, the external emergency circuit must be closed. The AC feed to the power modules is switched off when the AC breaker is released, and there is no output voltage present. The control module provides power to the control unit, which makes it possible to maintain serial communication.

NOTE: 24V is the maximum voltage allowed for signal inputs and outputs.
If a higher voltage is applied the unit could break down.

The external emergency stop must be connected to circuit board A12, terminals X2:3 and X2:4 in the control module. **The contacts must be isolated**. The current across the contacts is nominal 0.5A and max. 9A. Voltage is 24VDC

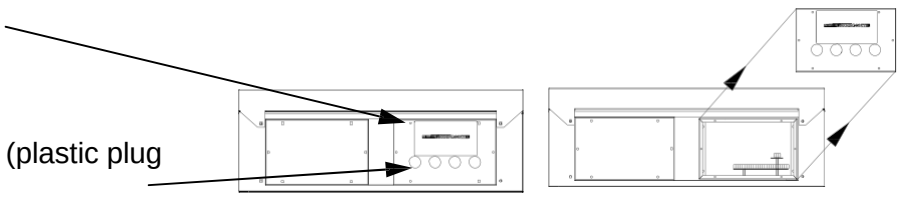
Loosen the cover with holes for cable (4 screws)

Open the cover plate with knockouts for cable glands (4 screws).
Signal connections on terminal blocks inside the control module are made using suitable connectors (the female part of the connector is supplied with the unit), so that the cable can be secured in the cable gland and the connector/connectors fitted with the cover plate removed from the control module. To assemble, add the connectors in the control module and then secure the cover plate.

Labels for options.

Connecting control cables

Hole for cables diameter 0.8” (plastic plug included)



3.5 TESTS BEFORE START-UP

Check that there is no condensation or risk of condensation before connecting to the mains supply. Condensation can form if the unit is cold and is then taken into a warm, damp building. When this is the case, let the power supply stand in the building for 24 hours before powering up.

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3.5.1 Tests without a load connected

Switch on the 3-phase AC supply. The power supply should start in OFF mode.
The display should now show information. If the unit is set to REMOTE, switch to LOCAL. Start the power supply in STANDBY mode by pressing the “ON” key.
The display should come on and the power supply should be in STANDBY mode.

Adjust the set point values for the current and voltage to Min.
Permit output current/voltage and switch the unit to RUN by pressing the “ON” key.

Check that no current or voltage is present on the DC output bus bars.
Adjust the set point value for the current to approximately 10% of the rated current. Check that the output voltage can be set to between 0 volt and the rated voltage.
It takes a long time (up to one minute) for the output voltage to drop to the new set value when lowering the set point value when no load is connected. To shorten the time, a resistor can be used for discharging the output. A resistor that gives a load current of 1-2 A can be connected for easier tests.
NOTE: The fans in the power modules will not run if the output is low or zero.

Switch off the power supply by pressing the “OFF” key to switch to STANDBY mode; press “OFF” again to switch to OFF mode.

3.5.2 Test with a load connected

If there is a load available, connect it and check if it can provide a suitable load from the data sheet, measured or by running the test and using voltage and current values to determine whether or not the load is suitable. At 20-100% of the nominal current, the voltage should be 20-100% of the nominal voltage.

When no load is available, the outputs can be short circuited using a cable with an appropriate cross section depending on the power supply's rated current.

Switch on the 3-phase AC supply. The power supply should start in OFF mode.
The display should now show information. If there is no information on the display, check if there is AC power to the unit.
Start the power supply in STANDBY mode by pressing the “ON” key
If the unit is set to REMOTE, switch to LOCAL.

Adjust the set point value for the voltage to approximately 50% of the rated voltage Adjust the set point value for the current to zero.
Permit output current/voltage and switch the power supply to RUN by pressing the “ON” key.

Check if the current and voltage can be increased and decreased to values that the power supply's rating and connected load permit.
Check if the fans in the power modules are running when the output current is >20%. Switch off the power supply by pressing the “OFF” key to switch to STANDBY mode; press “OFF” again to switch to OFF mode.

4 MANUAL CONTROL

4.1 FRONT PANEL CONTROLS & INDICATORS

The power supply is operated manually using the display on the front of the control module.

Using the display unit, the unit is switched on and off, voltage and current limits can be set independently of each other, and the unit can be blocked during pauses in the process. The most common settings are made directly with dedicated keys on the panel. Less frequently used settings are made by means of menu options in response to plain text messages on the

4.1.1 LCD Display & Keypad

ON	Starts the unit
OFF	Stops the unit
Current ⇑	Increases the current
Current ⇓	Decreases the current
Voltage ⇑	Increases the voltage
Voltage ⇓	Decreases the voltage
Menu keys A-D	Menu selections
OK!	Confirming a change (Deactivated in some sub-menus)
ESC	To cancel a change or exit a menu (Deactivated in some sub-menus)

The keypad is activated using a password protected menu. The longer a key is pressed, the faster the set values change and stop at zero.
In REMOTE mode, some or all control functions cannot be operated from the display unit and are instead controlled by serial communication or by external analog control signals. If the power supply is not in REMOTE mode it can only be operated from the display unit.

4.1.2 LED indication

The panel is equipped with LED status lamps for the following functions:

ON	Green LED	Indicates the unit is switched on.
ALARM	Red LED	Indicates the end of the process or unit fault. LED flashes in case of a WARNING and is lit continuously in case of an ALARM
REMOTE	Yellow LED	Indicates the unit is controlled by remote control

4.1.3 Audio signals

The panel is equipped with a buzzer that sounds to confirm keypad use, end of process (EOP) and a rectifier fault. The buzzer sound indication can be turned off in the CFG/USR menu.

4.1.4 LCD display

The LCD display is a high contrast graphic type with a lit background.
The display contrast may need to be adjusted depending on the ambient temperature and age. Adjustment is made from the configuration menu.
The background is lit when a key is pressed and remains on for 60 seconds after the last key is pressed.

Display	LCD 128x6, backlit
LED indication	ON, Alarm, Remote
Sound indication	Yes
Keypad	Yes
Processor	16-bit microcontroller
A/D D/A resolution	10/12 bit
Interface	RS-485 (Profibus)
Interface	RS-232 (Modbus)

4.1.5 Special functions

The unit's control system is configured at the factory, however, if for some reason you wish to reset the settings to default values, this can be done by holding down the ESC key for longer than 8 seconds.

NOTE - The SET parameters, Ah counter and process timer are reset to zero.
- The CFG settings are not changed (the buzzer is switched on if it has been switched off)
-The software is not changed.

The buzzer sounds when the system has been reset.

The system is reset if the OFF key is pressed for 5 seconds. The buzzer sounds to indicate that reset has occurred.

4.1.6 Alarms / Warnings / Fault messages

The control unit continuously monitors the unit and tries to recover from different fault modes that can occur during operation. This function can also be used if the controller has for some reason entered the wrong program mode or appears to have locked up. While the unit is trying to correct a fault, the alarm LED on the control panel flashes and a fault message is displayed. If the unit includes I/O PCB, a signal can be sent to an external control system. If a major fault occurs, which cannot be corrected, an ALARM is triggered.

This is indicated by a continuously lit red LED on the control panel and a fault message on the display. If sound indication is set to ON, the buzzer will sound. The buzzer is turned off by pressing any key.

Fault is reset by switching the power supply OFF using the keypad or serial communication. Alternatively, send the ALARM RESET command using the DIG IN digital input.

ALARM = The unit stops.
WARNING = The unit continues to operate with reduced output power.
The ALARM signal is activated in the event of either an ALARM or WARNING.
The "POWER GOOD" signal is deactivated in the event of an ALARM or WARNING.

Message	Explanation
"HIGH TEMP! P-M"	Excess temperature in a power module. Too high temperature on the output causes over temperature in the power module. (The output from the affected power module is cut as long as the temperature remains too high. The "power good" LED is off on the power continues to operate with the remaining power modules, the output current is decreased accordingly.
"HIGH TEMP C-M"	Excess temperature in the control module. The unit continues to operate. The output current is unaffected.
"REGULATIONERR"	Regulator control error in a power module. (The unit continues to operate and the "powergood" LED is off on the power module that has sent the warning signal).The output current is decreased accordingly. If all modules have "Power Good" LED off, check AC input if out of range or one phase missing
"MODULE FAILED!"	Reverse current in a power module. (The unit stops. The "powergood" LED is off on the power module that has sent the alarm signal)

The cause of an ALARM must be identified - see Troubleshooting instructions

The display can also show four fault messages:

Message	Explanation
"ILLEGAL PARAMETER"	Shows that a set value sent via serial communication is out of range. If the set value is above range, it will be set to maximum range value. If the set value is below range, it will be set to minimum range value.
"INTERNAL FAULT 256"	Shows an internal software problem. Restart the unit (OFF) and check if the fault disappears. Report when the fault occurred.
"MAX POWER" (ALARM LED flashes)	The output of the unit does not correspond to the set values of current and voltage due to power limitation.

When an EOP for elapsed time limit or ampere hour limit is reached the "ALARM" LED Flashes - see "Setting the time limit" and "Setting the Ah limit" for information.

4.1.7 Operating modes

The power supply can be connected & operated as follows:

Parallel	Power module sub-modules are connected in parallel supplying the rated output voltage and current
Series	Power module sub-modules are connected in series supplying double the rated output voltage and 1/2 of the rated current
Dual	Power module sub-modules are independent, supplying 2 x the rated output voltage and 2 x 1/2 the current. Both sides are switched on and off at the same time. However, set values for current and voltage can be set different for each side

4.2 PASSWORD

Some menus and settings are password protected. **The default password is 000001**
Ask for a new password should the old one be lost.

4.3 OPERATING FUNCTIONS

4.3.1 Process timer

The operation of the unit can be timed. When this time limit has expired, an EOP (End of Process) signal is generated.
The number of seconds since the start of the process are shown on the display.
The unit resumes operation after a power loss provided the parameter POWER ON MODE is set to CONTINUE, and the timer resumes from the time of the power loss.

The Time limit, 0-999999s, is set in the SET menu. The EOP mode is set in the menu CFG/USR, see “User menu”. Timer accuracy: +- 0.1% (resolution 1s) Example: At set value of 1000s the time will be +- 1s.

If you need to reset the timer, use the OFF key to Standby mode, at restart with the ON key, the timer is reset. The process timer can also be reset using the ’CLEAR’ command in the DUTY menu, or by using a digital input, or serial communication.

4.3.2 Ampere hour counter function

An Ah limit can be set. When the Ah limit has expired, an EOP (end of process) signal is generated. See EOP (End Of Process). The number of Ah since the start of the process is shown on the display.
The unit resumes operation after a power loss provided the parameter POWERONMODE is set to CONTINUE, and the timer resumes from the time of the power loss.
The Ah limit,0-999999Ah, and STARTUP mode is set in the SET menu. The EOP mode is set in the menu CFG/USR, “User menu”. Ah counter accuracy: +- 1% of output current 10-100% of rated current. Example: At a set value of 100Ah the limit will be 1Ah .

If you need to reset the AH counter, use the OFF key to Standby mode, at restart with the ON key, the Ah counter is reset. The ampere hour counter can also be reset using the ’CLEAR’ command in the DUTY menu, or by using a digital input, or serial communication.

4.3.3 Start ramp

A time can be set within the voltage and current ramps from zero to set value during a pre set time. The time is set using the SET menu and the parameter STARTRAMP.
The start ramp time, 0.5-3000s is set in the SET menu by the parameter STARTRAMP. The start ramp time applies also to both sides in DUAL modes. This time also applies in program mode.

4.3.4 EOP (End Of Process)

EOP is obtained when the a set time expires or the set Ah is reached.
At EOP, the unit can block, go to a set HOLD level or only give a signal with LED and buzzer, and continue operation.
These settings are made in the CFG/USER menu. See “User menu”.
The OFF command restarts in STANDBY mode; ON restarts the unit.

4.3.5 Resolution, current indication

The resolution of the current value can be set to 0.1A or 1A. The settings are made by the parameter HIRES in the CFG/USER menu. See “User menu”. 0.1A resolution is only available on units with nominal output current of 3000A or less.
Actual values and set values from serial communication and set values set from keyboard.

Nominal	Resolution default	Available resolutions	
1-100A	0.1A	0.1A	1A
100-3000A	1A	0.1A	1A
3000-6000A	1A		1A

NOTE: The resolution affects the scaling in the serial communication. Which resolution that is effective is accessible in status register b10.
The LCD display shows the actual current with 0.1A resolution up to 999.9A and 1A resolution from 1000A and above independent of the setting of HIRES. The LCD current resolution does not affect the accuracy of the unit.

4.3.6 Reduction of output current and output voltage

The unit's maximum set value for output current and output voltage can be reduced in the CFG/USER menu. See "User menu". This function can be used if output current, output voltage or max input power needs to be limited.

NOTE: If the output current and\or output voltage are increased from the limited values with additional power modules, the installation must be re-assessed regarding cable cross-sections, fuses, etc.

4.3.7 Blocking

In DUAL, SERIES and PARALLEL mode the unit can be blocked from the keypad, using the SET menu, or by serial communication.

4.3.8 Fan control

The fans in the power modules are controlled by the output current and switch off when this is low (< approx. 5%). There is a delay of a few seconds before a fan switches on or off.

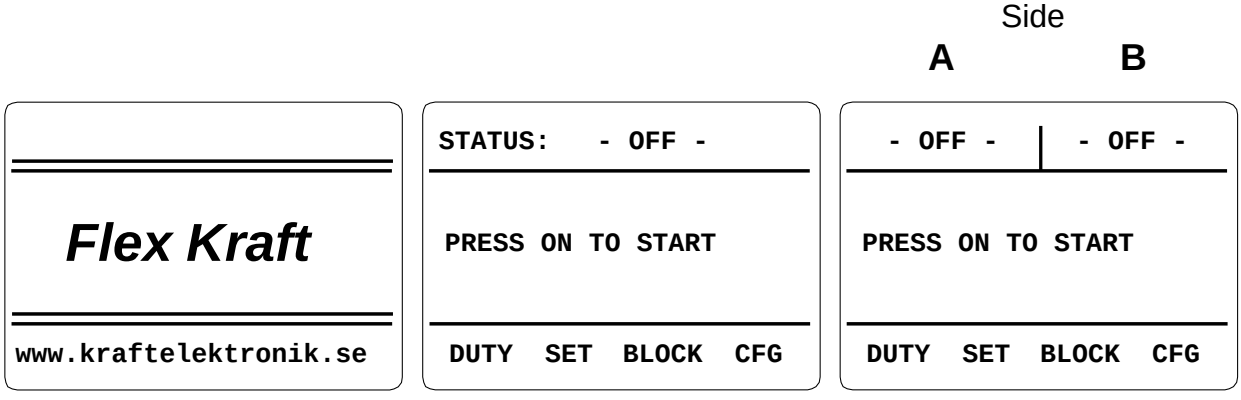
5 MENU SYSTEM

Parameters are set by increasing or decreasing the relevant parameter with the corresponding key on the keypad. If the key is held down, the parameter counts up or down at an increasing rate. If a parameter can change sign, the value stops at zero. To change sign and continue, release the key and press again.

On some menus there is not enough space on the display for all the information. The menu keys can then be used to scroll the information up and down.

Some menu settings are for options. When these options are not included, the settings should be set to OFF(-NONE-).

5.1 START MENU

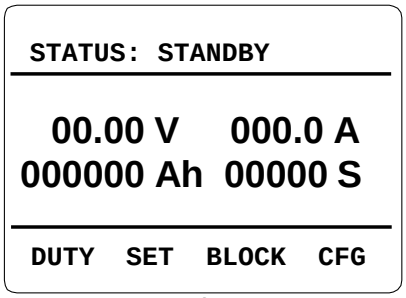


Welcome screen
Displayed for some seconds

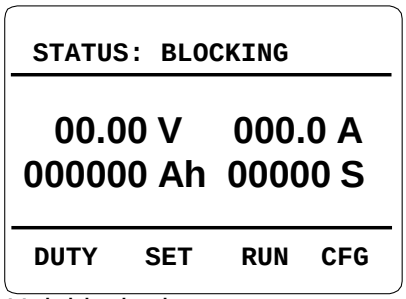
Example of start screen
The unit can be configured to go to OFF, REMOTE, CONTINUE or RUN
when mains power is connected.

5.2 MAIN MENU

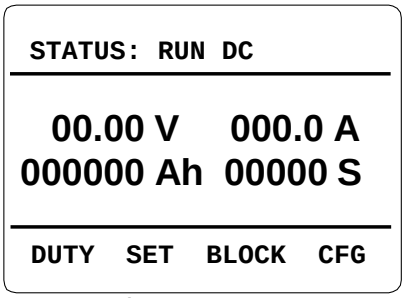
PARALLEL and SERIES



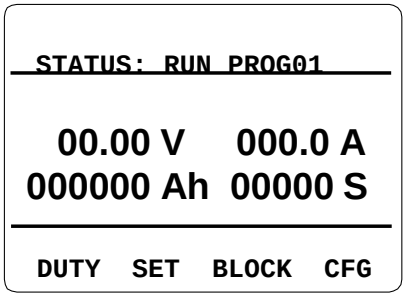
STANDBY mode



Unit blocked

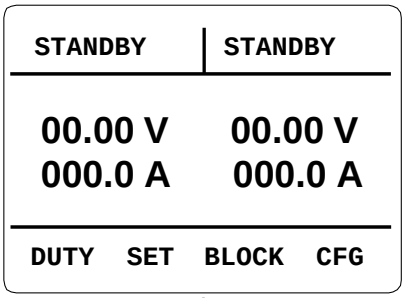


RUN mode DC

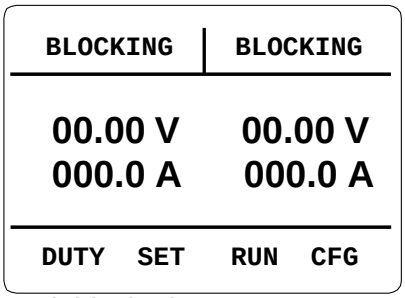


RUN mode PROGRAM

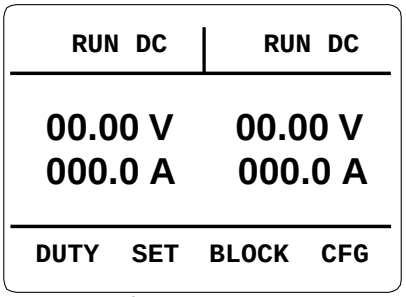
DUAL



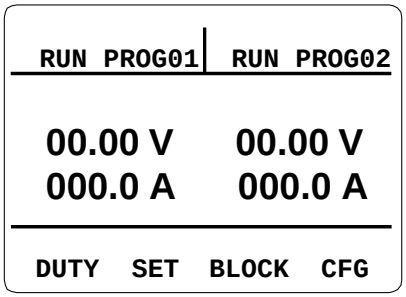
STANDBY mode



Unit blocked

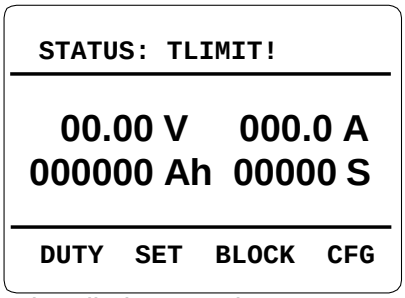


RUN mode DC



RUN mode PROGRAM

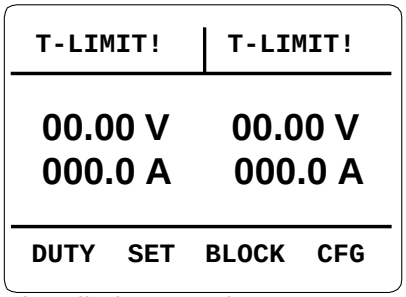
PARALLEL and SERIES



Time limit passed

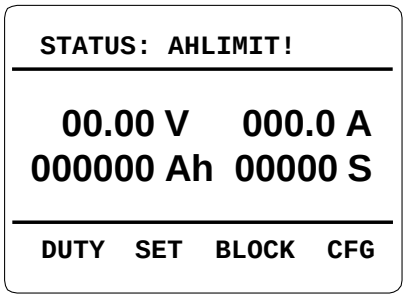
ALARM LED flashes and Buzzer sounds
sounds if BUZZER=ON

DUAL

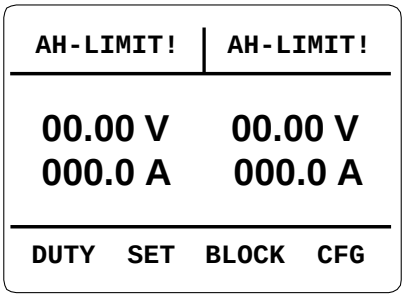


Time limit passed

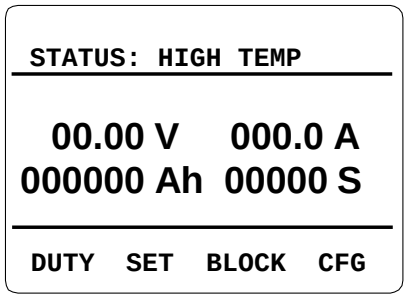
ALARM LED flashes and Buzzer
if BUZZER=ON
In program mode with DUAL, one side can stop at **T-LIMIT!** while the other continues to run. In program mode **T-LIMIT!** is equal to program end.
In normal mode, **T-LIMIT!** is the same for both sides.



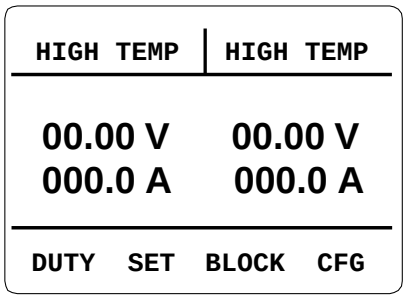
Ah limit passed
ALARM LED flashes and Buzzer sounds
sounds if BUZZER=ON



Ah limit passed
ALARM LED flashes and Buzzer
if BUZZER=ON.
In program mode and normal mode with DUAL one side can stop at **AH-LIMIT!**
while the other continues to run.

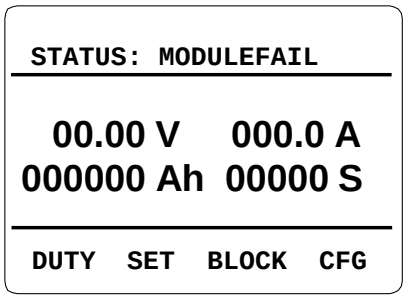


Temperature alarm from power module.



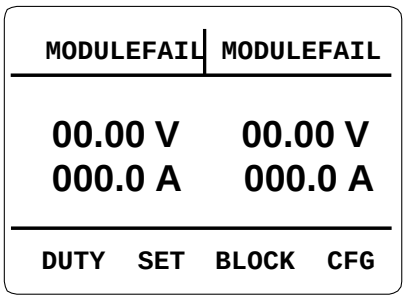
Temperature alarm from power module.

PARALLEL and SERIES

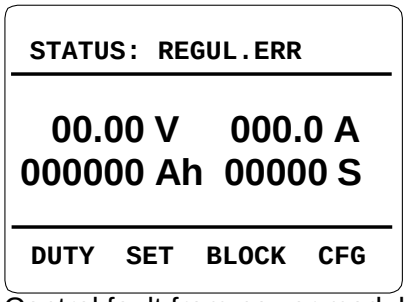


Alarm from power module.

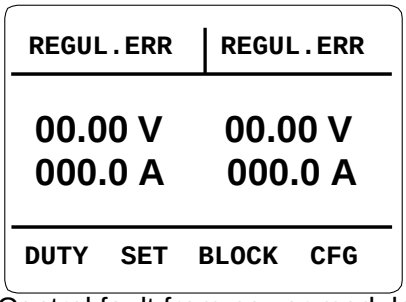
DUAL



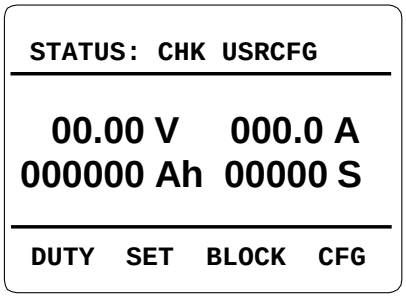
Alarm from power module.



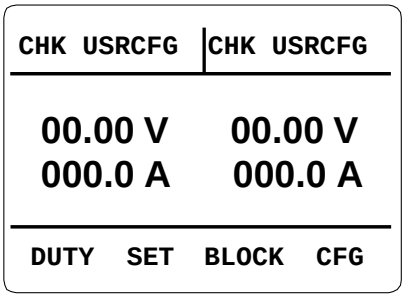
Control fault from power module.



Control fault from power module.



Unit is incorrectly configured.



Unit is incorrectly configured.

Check settings

The BLOCK key toggles between BLOCK and RUN

5.3 CFG MENU

```
 SELECT SUB-MENU OR
 PRESS ESC TO EXIT!


FIRMWARE
FLX-01 VER xx.xx
──────────────────────
PROG  USER  CAL KRAFT
```

5.3.1 Programming menu

```
ENTER
PASSWORD. 000000

(PRESS OK)
──────────────────────
              ←    →
```

Default password is 000001

If you forgot a password ask for a new one.

```
 SELECT PROGRAM TO
 EDIT OR COPY.


PROGRAM: 01

──────────────────────
 ←    →   EDIT  COPY
```

5.4 SETTINGS MENU

PARALLEL and SERIES	DUAL
First menu display REMOTE CONTROL : NO SETVOLTAGE : 00.00 V SETCURRENT : 000.0 A RUN/BLOCK : RUN START/STOP : STOP TIMERLIMIT : -OFF- S ← → ↓ ↑	First menu display REMOTE CONTROL : NO SETVOLTAGE A: 00.00 V SETVOLTAGE B: 00.00 V SETCURRENT A: 000.0 A SETCURRENT B: 000.0 A RUN/BLOCK : RUN ← → ↓ ↑

SET MENU FOR PARALLEL AND SERIES

All choices:	Choice/indication alternative
REMOTE CONTROL : NO	NO, YES
SETVOLTAGE : 00.00 V	Increase/decrease with arrow keys
SETCURRENT : 000.0 A	Increase/decrease with arrow keys
RUN/BLOCK : RUN	RUN, BLOCK
START/STOP : STOP	START, STOP
POLARITY : FWD	FWD, REV
TIMERLIMIT : -OFF- S	OFF, 0-999999 s
AH-LIMIT : -OFF-AH	OFF, 0-999999 Ah
START RAMP :0000.5 S	0000.5-3000,0 s

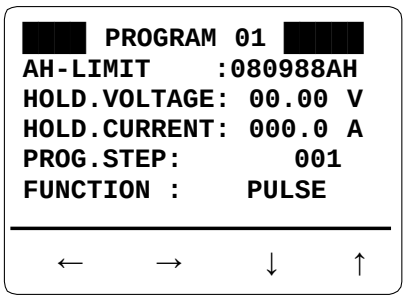
Press ”OK” to activate change.

SET MENU FOR DUAL

All choices:	Choice/indication alternative
REMOTE CONTROL : NO	NO, YES
SETVOLTAGE A: 00.00 V	Increase/decrease with arrow keys
SETVOLTAGE B: 00.00 V	Increase/decrease with arrow keys
SETCURRENT A: 000.0 A	Increase/decrease with arrow keys
SETCURRENT B: 000.0 A	Increase/decrease with arrow keys
RUN/BLOCK : RUN	RUN, BLOCK
START/STOP : STOP	START, STOP
POLARITY : FWD	FWD, REV
TIMERLIMIT : -OFF- S	OFF, 0-999999 s. Applies to side A and side B
AH-LIMIT A : -OFF-AH	OFF, 0-999999 Ah
AH-LIMIT B : -OFF-AH	OFF, 0-999999 Ah
START RAMP :0000.5 S	0000.5-3000,0 s (0.1–3000.0s via serial communication) Applies to side A and side B.
PROGRAMMODE A : NO	YES, NO
PROGRAMMODE B : NO	YES, NO
PROGRAM A NO : 01	01, 02, 03, 04
PROGRAM B NO : 01	01, 02, 03, 04

Press “OK” to activate change

5.5 EDIT MENU



All choices:	Choice/indication alternative
PROGRAM 01	Program number
AH-LIMIT :080988AH	-OFF-, 0-999999Ah
HOLD.VOLTAGE: 00.00 V	0-max nominal voltage. Step 0.01 V
HOLD.CURRENT: 000.0 A	0-max nominal current. Step 1 A
PROG.STEP: 001	1-8. Change PROG.STEP number to show parameters.
FUNCTION : PULSE	STEP, U-RAMP, I-RAMP, PULSE, REPEAT

Lines under FUNCTION change depending on which FUNCTION is chosen.

Function: STEP	Choice/indication alternative
FUNCTION : STEP	
VOLTAGELEVEL: 06.00 V	0-max nominal voltage
CURRENTLEVEL: 150.0 A	0-max nominal current
STEP TIME: 000088 S	0-30000 sec

Function: U-RAMP	Choice/indication alternative
FUNCTION : U-RAMP	
VOLTAGELEVEL: 06.00 V	0-max nominal voltage
CURRENTLEVEL: 150.0 A	0-max nominal current
STEP TIME: 000088 S	0-30000sek

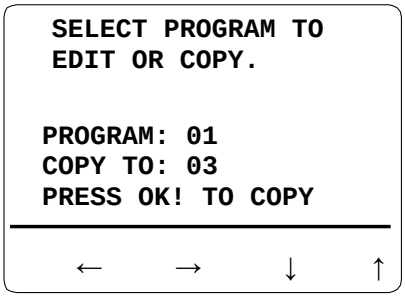
Function: I-RAMP	Choice/indication alternative
FUNCTION : I-RAMP	
VOLTAGELEVEL: 06.00 V	0-max nominal voltage
CURRENTLEVEL: 150.0 A	0-max nominal current
STEP TIME: 000088 S	0-30000 sec

Press ”OK” to activate change.

STEP TIME or CYCLES can be used to set time/number of cycles. The parameter that is not used is calculated automatically.

NOTE! The start ramp in the CFG/USER menu affects the start sequence and overwrites whatever is set in the program.

5.6 COPY MENU



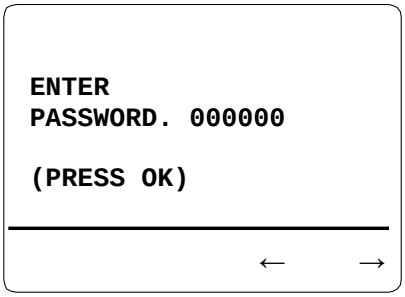
All choices: Choice/indication alternative

PROGRAM: 01 01, 02, 03, 04

COPY TO: 03 01, 02, 03, 04

Press ”OK” to activate change.

5.7 USER MENU



Default password is 000001

If you forget a password, ask for a new one.

First menu display

```
LCD-CONTRAST: 050.0 %
PASSWORD    :000001
PROTOCOL :PROFIBUS DP
BYTESWAP :      YES
ADDRESS  :    00002
BAUDRATE : AUTODETECT

  ←     →     ↓     ↑
```

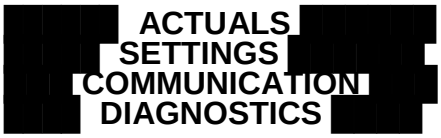
All choices:	Choice/indication alternative
LCD-CONTRAST: 050.0 %	Set contrast using arrow keys
PASSWORD :000001	Set password using arrow keys
PROTOCOL :PROFIBUS DP	--NONE--, PROFIBUS DP, MODBUS RTU
BYTESWAP : YES	YES,NO
ADDRESS : 00002	Set address using arrow keys. Default=2 0-247 for PROFIBUS DP, 0-230 for MODBUS RTU
BAUDRATE : AUTODETECT	MODBUS: 4800, 9600, 19200, 38000 BPS PROFIBUS: AUTODETECT (9.6kBPS to 12MBPS)
MBTIMEOUT: 000000MS	0-50MS
SLAVEMODE: NO	YES,NO
POWERONMODE: OFF	OFF, REMOTE, CONTINUE, RUN
OUTPUTMODE : SERIES	DUAL, PARALLEL, SERIES,
EOP MODE : STOP	STOP, CONTINUE, HOLD
HOLD LEVEL : 010.0%	0-100% of set value.
AUTODOS. : -OFF-AH	-OFF-, 0-30000 Ah
PULSELENG. : 000.5 S	0 to 999.9 s
AUTODOS. A : -OFF-AH	-OFF-, 0-30000 Ah
PULSELENG.A: 000.5 S	0 to 999.9 s
AUTODOS. B : -OFF-AH	-OFF-, 0-30000 Ah
PULSELENG.B: 000.5 S	0 to 999.9 s
BUZZER : OFF	OFF, ON
CURR.HIRES: AUTO	OFF, ON, AUTO
MAX VOLTAGE: 30.00 V	0-MAX output voltage at unit
MAX CURRENT: 03000 A	0-MAX output voltage at unit
POL.REV.: YES	NO, YES
	DIG IN inputs can have the following signals. Signals are in the order shown on the display.
DIG IN 1: - NONE -	–NONE-,ON/OFF,START/STOP,BLOCK/RUN,RESTART,
DIG IN 2: - NONE -	INC VOLT. A, DEC VOLT. A,INC CURR. A,
DIG IN 3: - NONE -	DEC CURR. A, INC VOLT. B, DEC VOLT. B,
DIG IN 4: - NONE -	INC CURR. B, DEC CURR. B, BLOCK/RUN A , BLOCK/RUN B,AUX IN A, AUX IN B, START/STOPA, START/STOPB, POL.CTRL A, POL.CTRL B, EXT.ALARM A, EXT.ALARM B, RUN/BLOCK, RUN/BLOCK A, RUN/BLOCK B, ENABLE, ENABLE A, ENABLE B, EXT.ALARM 1, ALARM RESET (Current at input gives first function Example: current at signal ON/OFF input gives ON)

INCREASE/DECREASE function: 0-100% in 10 seconds.
If the EXT.ALARM 1 parameter is configured as a digital input, it is activated regardless of the setting of the REMOTE parameter. The signal is inverted and must be false (current at input), otherwise the rectifier will not start.

Keys are disabled when REMOTE=YES and PROTOCOL=PROFIBUS or MODBUS. If the unit loses contact with the PROFIBUS MASTER the keys will be activated.
The keys are activated when REMOTE=YES and PROTOCOL=-NONE-, but have lowest priority.

5.8 DUTY MENU

Information is displayed in the following order in the Duty menu.



The information under each heading changes depending on the settings for operating mode, program mode and communication. See below.

5.8.1 PARALLEL and SERIES mode

Without program function	With program function
First menu display ACTUALS VOLTAGE : 00.00 V CURRENT : 000.0 A AHCOUNTER : 000021AH PROCESS TMR : 080988 S REMAINING : 00006 M CLEAR ↓ ↑	First menu display PROGRAM PROGRAM NO : 01 PROGRAM STEP: 001 AH-COUNTER :000021AH PROCESS TMR :080988 S REMAINING : 00006 M CLEAR ↓ ↑
ACTUALS VOLTAGE : 00.00 V CURRENT : 000.0 A AHCOUNTER :000021AH PROCESS TMR :080988 S REMAINING :-00006 M SETTINGS SETVOLTAGE : 00.00 V SETCURRENT : 000.0 A AH-LIMIT : -OFF-AH TIMERLIMIT : -OFF- S STARTRAMP :0001.0 S	ACTUALS PROGRAM NO : 01 PROGRAM STEP: 001 AH-COUNTER :000021AH PROCESS TMR :080988 S REMAINING : 00006 M VOLTAGE : 00.00 V CURRENT : 000.0 A SETTINGS SETVOLTAGE : 00.00 V SETCURRENT : 000.0 A STARTRAMP :0001.0 S

5.8.2 DUAL mode

Without program function	With program function
First menu display ACTUALS A-SIDE VOLTAGE : 00.00 V CURRENT : 000.0 A AHCOUNTER :000021AH PROCESS TMR :080988 S REMAINING : 00000 M CLEAR ↓ ↑	First menu display ACTUALS A-SIDE PROGRAM NO : 01 PROGRAM STEP: 001 AH-COUNTER :000021AH PROCESS TMR :080988 S REMAINING : 00006 M CLEAR ↓ ↑

▒▒ ACTUALS A-SIDE ▒▒ VOLTAGE : 00.00 V CURRENT : 000.0 A AHCOUNTER :000021AH PROCESS TMR :080988 S REMAINING : 00000 M ▒▒ SETTINGS A-SIDE ▒▒ SETVOLTAGE : 00.00 V SETCURRENT : 000.0 A AH-LIMIT : -OFF-AH TIMERLIMIT : -OFF- S STARTRAMP :0000.5 S ▒▒ ACTUALS B-SIDE ▒▒ VOLTAGE : 00.00 V CURRENT : 000.0 A AHCOUNTER :000021AH PROCESS TMR :080988 S REMAINING : 00000 M ▒▒ SETTINGS B-SIDE ▒▒ SETVOLTAGE : 00.00 V SETCURRENT : 000.0 A AH-LIMIT :000002AH TIMERLIMIT : -OFF- S STARTRAMP :0001.0 S ▒▒▒ ACTUALS COMMON ▒▒ VOLTAGE AVG : 00.00 V VOLTAGE A+B : 00.00 V CURRENT A+B : 000.0 A AHCOUNTERA+B:000021AH	▒▒ ACTUALS A-SIDE ▒▒ PROGRAM NO : 01 PROGRAM STEP: 001 AH-COUNTER :000021AH PROCESS TMR :080988 S REMAINING : 00006 M VOLTAGE : 00.00 V CURRENT : 000.0 A ▒▒ SETTINGS A-SIDE ▒▒ SETVOLTAGE : 00.00 V SETCURRENT : 000.0 A STARTRAMP :0001.0 S ▒▒ ACTUALS B-SIDE ▒▒ PROGRAM NO : 01 PROGRAM STEP: 000 AH-COUNTER :000021AH PROCESS TMR :080988 S REMAINING : 00006 M VOLTAGE : 00.00 V CURRENT : 000.0 A ▒▒ SETTINGS B-SIDE ▒▒ SETVOLTAGE : 00.00 V SETCURRENT : 000.0 A STARTRAMP :0001.0 S ▒▒▒ ACTUALS COMMON ▒▒ VOLTAGE AVG : 00.00 V VOLTAGE A+B : 00.00 V CURRENT A+B : 000.0 A AHCOUNTERA+B:000021AH

PROCESS TMRshows the time elapsed in the current program step.
REMAININGshows the time remaining until the end of program step 8.

5.8.3 COMMUNICATION for no protocol

All choices: **Choice/indication alternative**

▒▒▒ COMMUNICATION ▒▒▒
PROTOCOL : -- NONE --
ADDRESS : 000002
BAUDRATE : ---- BPS
CTRL:0000000000000001
STAT:0000000100000000
PROTOCOL: -- NONE --
PROTOCOL: -- NONE --

5.8.4 PROFIBUS COMMUNICATION

All choices: **Choice/indication alternative**

▒▒▒ COMMUNICATION ▒▒▒
PROTOCOL :PROFIBUS DP
ADDRESS : 000002
BAUDRATE : AUTODETECT
CTRL:0000000010000001
STAT:0000001101000000
DP-STATE :WAIT PRM
WD-STATE :BAUDSRCH

5.8.5 MODBUS COMMUNICATION

```
All choices:                Choice/indication alternative
    COMMUNICATION
PROTOCOL : MODBUS RTU
ADDRESS  :     000002
BAUDRATE :   38.4KBPS
CTRL:0000000000000001
STAT:0000001000000000
MSG RECEIVED:  000000
CHR RECEIVED:  000000
```

5.8.6 DIAGNOSTICS

```
All choices:                Choice/indication alternative
    DIAGNOSTICS
PARAMERROR  :  000000
MODULESFOUND:  000005
MAX CURRENT1: 01500 A     Limited values are not shown
AT   VOLTAGE1: 24.00 V      Limited values are not shown
MAX CURRENT2: 01500 A     Limited values are not shown AT
VOLTAGE2: 24.00 V      Limited values are not shown R01
:1101000000000000     For troubleshooting.
R02 :1000000000111111     For troubleshooting.
R03 :0000000000000000     For troubleshooting.
R04 :          000046     For troubleshooting.
R05 :          065535     For troubleshooting.
R06 :          000000     For troubleshooting.
R07 :          043956     For troubleshooting.
R08 :      0000000000     For troubleshooting.
R09 :         000.0 A     For troubleshooting.
R10 :         000.0 A     For troubleshooting.
R11 :         000.0 A     For troubleshooting.
R12 :         000.0 A     For troubleshooting.
R13 :         00.00 V     For troubleshooting.
R14 :         00.00 V     For troubleshooting.
R15 :         00.00 V     For troubleshooting.
R16 :         00.00 V     For troubleshooting.
```

5.8.7 SETTINGS

PARALLEL and SERIES	DUAL
First menu display REMOTE CONTROL : NO SETVOLTAGE : 00.00 V SETCURRENT : 000.0 A RUN/BLOCK : RUN START/STOP : STOP TIMERLIMIT : -OFF- S ← → ↓ ↑	First menu display REMOTE CONTROL : NO SETVOLTAGE A: 00.00 V SETVOLTAGE B: 00.00 V SETCURRENT A: 000.0 A SETCURRENT B: 000.0 A RUN/BLOCK : RUN ← → ↓ ↑

SET MENU FOR PARALLEL AND SERIES

All choices:	Choice/indication alternative
REMOTE CONTROL : NO	NO, YES
SETVOLTAGE : 00.00 V	Increase/decrease with arrow keys
SETCURRENT : 000.0 A	Increase/decrease with arrow keys
RUN/BLOCK : RUN	RUN, BLOCK
START/STOP : STOP	START, STOP
POLARITY : FWD	FWD, REV
TIMERLIMIT : -OFF- S	OFF, 0-999999 s
AH-LIMIT : -OFF-AH	OFF, 0-999999 Ah
START RAMP :0000.5 S	0000.5-3000,0 s
PROGRAMMODE : NO	YES, NO
PROGRAM NO : 01	01, 02, 03, 04

Press ”OK” to activate change.

SET MENU FOR DUAL

All choices:	Choice/indication alternative
REMOTE CONTROL : NO	NO, YES
SETVOLTAGE A: 00.00 V	Increase/decrease with arrow keys
SETVOLTAGE B: 00.00 V	Increase/decrease with arrow keys
SETCURRENT A: 000.0 A	Increase/decrease with arrow keys
SETCURRENT B: 000.0 A	Increase/decrease with arrow keys
RUN/BLOCK : RUN	RUN, BLOCK
START/STOP : STOP	START, STOP
POLARITY : FWD	FWD, REV
TIMERLIMIT : -OFF- S	OFF, 0-999999 s. Applies to side A and side B
AH-LIMIT A : -OFF-AH	OFF, 0-999999 Ah
AH-LIMIT B : -OFF-AH	OFF, 0-999999 Ah
START RAMP :0000.5 S	0000.5-3000,0 s (0.1–3000.0s via serial communication) Applies to side A and side B.
PROGRAMMODE A : NO	YES, NO
PROGRAMMODE B : NO	YES, NO
PROGRAM A NO : 01	01, 02, 03, 04
PROGRAM B NO : 01	01, 02, 03, 04

Press “OK” to activate change

5.8.7.1 Setting the current and voltage

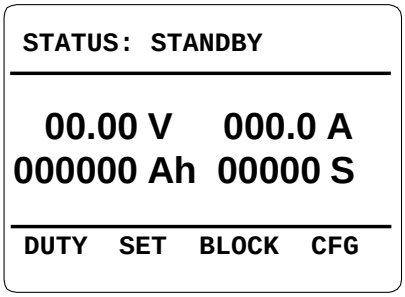
The current and voltage can be set during operation or before starting the power supply.

Change the voltage during operation with the “VOLTAGE” arrow keys to increase or decrease the values.
Change the current during operation with the “CURRENT” arrow keys to increase or decrease the value.

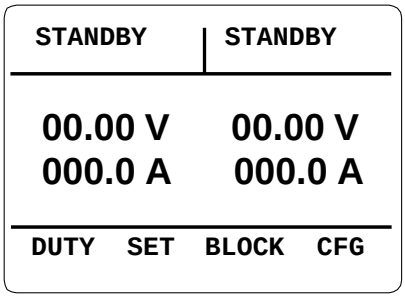
NOTE: If the power supply is in DUAL mode, the set values for both sides are changed equally and simultaneously if the arrow keys on the keypad are used. **The set values can be set individually in the SET menu.**

If required, set the initial voltage and current values before starting using the SET menu. Both methods can be used in STANDBY and RUN mode.

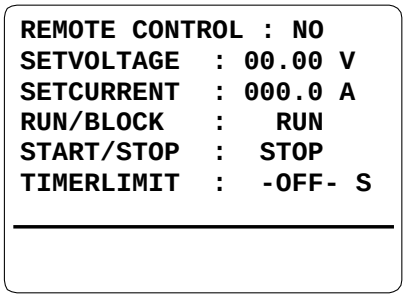
PARALLEL, SERIES



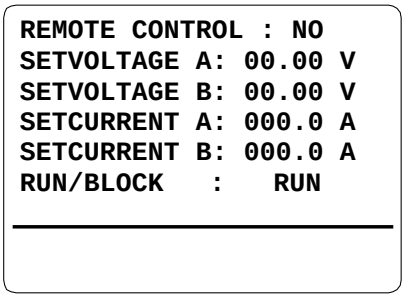
DUAL



The set menu



The set menu

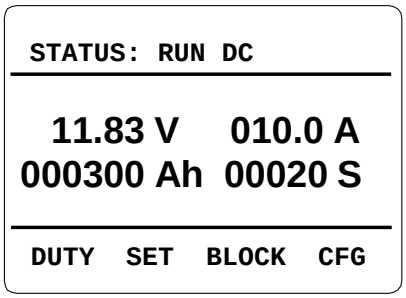


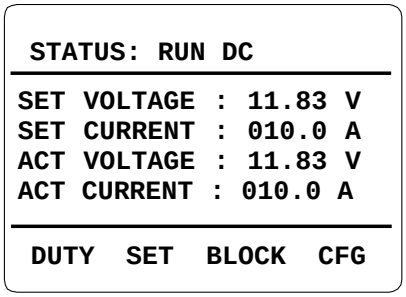
5.8.7.2 Increase/decrease keys for current and voltage

When any of the arrow keys are pressed for current or voltage, the display changes from showing large numbers to showing small numbers. The display reverts to normal after 10 seconds.

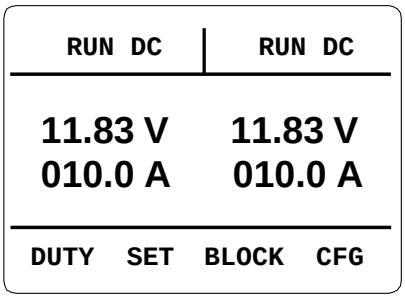
Example:

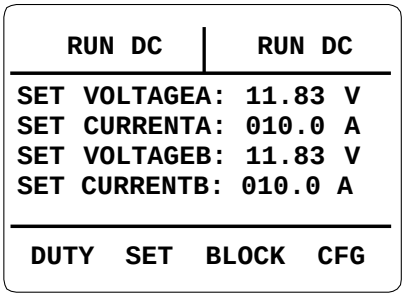
PARALLEL and SERIES





DUAL





When the arrow keys for current or voltage are pressed it changes the set value for both sides by the same amount. To change each side by different amounts, use the SET menu.

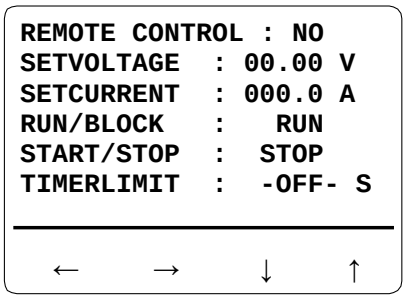
5.8.7.3 Setting the time limit

The power supply can be set, once a specific time has elapsed, to:

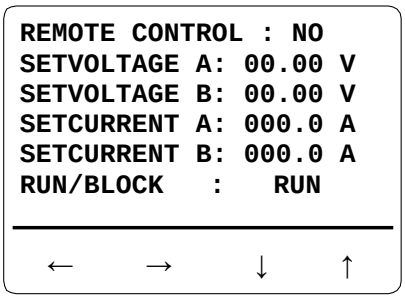
-Stop and give a signal
-Continue with operations and give a signal
-Change the output data to a HOLD level and give a signal. Set in CFG/USR menu using `EOP MODE`

The time is set in the SET menu using `TIMERLIMIT.`

PARALLEL, SERIES



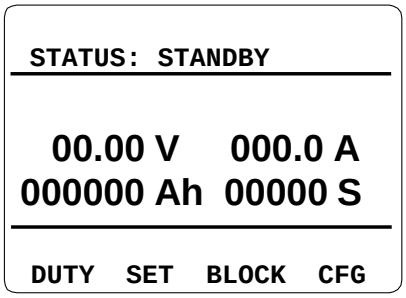
DUAL



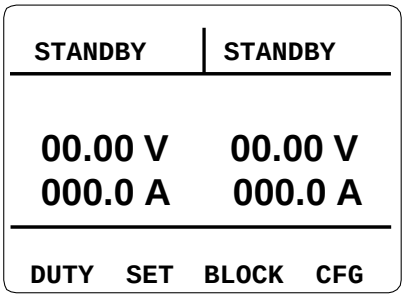
Press ↓ to get `TIMERLIMIT`

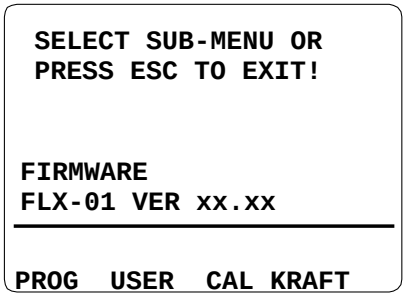
When the power supply should stop, use HOLD level or only light the ALARM LED when the set limit has been reached (option: contact to remote system) is set using the CFG/USER menu with the EOP MODE parameter.
NOTE that the settings also apply for the Ah limit. The CFG menu is password protected.

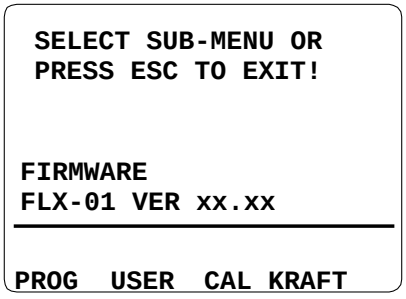
PARALLEL, SERIES



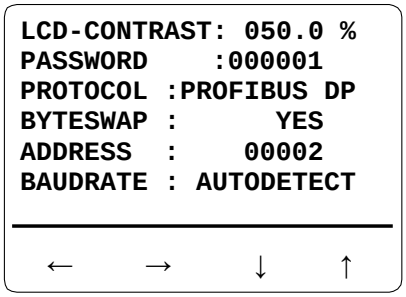
DUAL



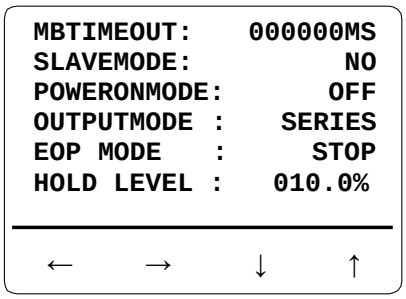




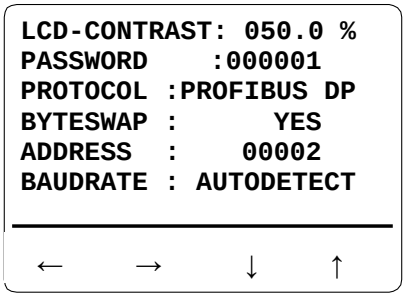
PARALLEL, SERIES



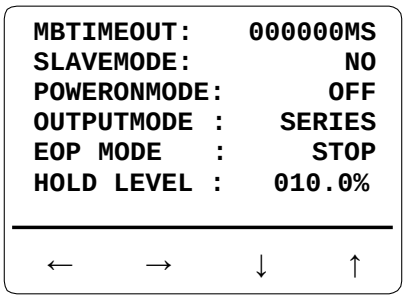
Press ↓ to get EOP MODE



DUAL



Press ↓ to get EOP MODE



Press “OK” to activate change.
Switch off the buzzer by pressing ESC.

Pausing the process:
The process can be paused before the set limit is reached by pressing the “OFF” key and then restarted by pressing “ON” key. A restart is also made if the “OFF” key has been pressed twice so that the unit is in “OFF” mode.

Interrupting the process:
Pause the process using the “OFF” key. Reset the counter in the DUTY menu with CLEAR. Restart the process from zero with the “ON” key.

Restart the process:
When the process has completed and an EOP has been obtained, the unitr is stopped/set in STANDBY mode using the “OFF” key. Restart the process from zero with the “ON” key.

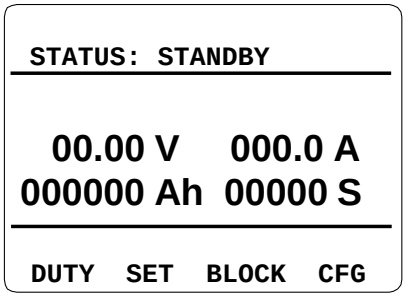
5.8.7.4 Setting the Ah limit

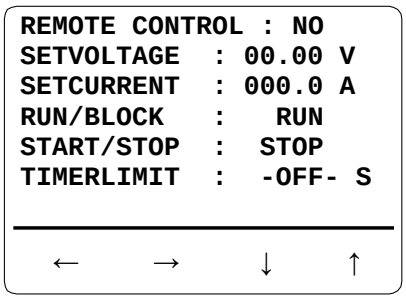
The power supply can be set, once a specific number of ampere hours have elapsed, to:

-Stop and give a signal
-Continue with operations and give a signal
-Change the output data to a HOLD level and give a signal. Set in CFG/USR menu using EOP MODE

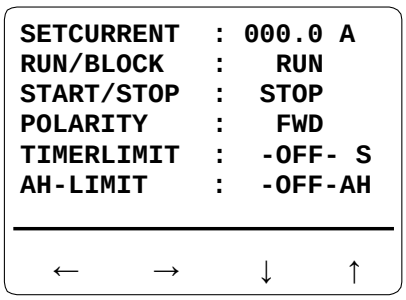
The number of ampere hours is set in the SET menu using AH-LIMIT A and AH-LIMIT B.

PARALLEL, SERIES

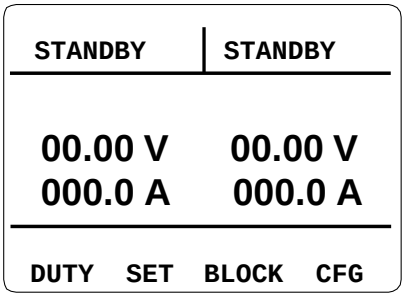


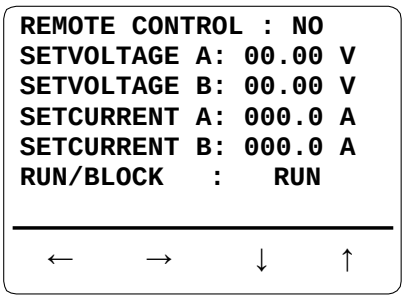


Press ↓ to get AH-LIMIT A

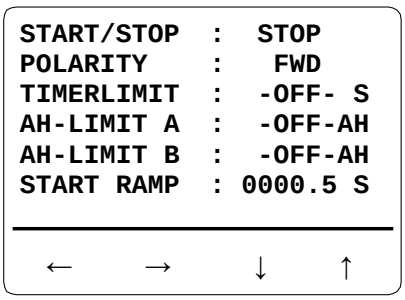


DUAL



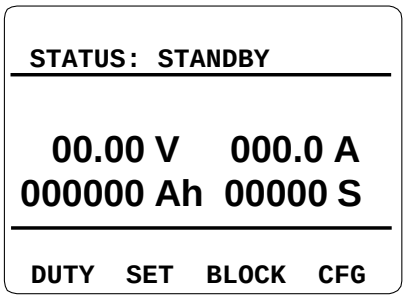


Press ↓ to get AH-LIMIT A

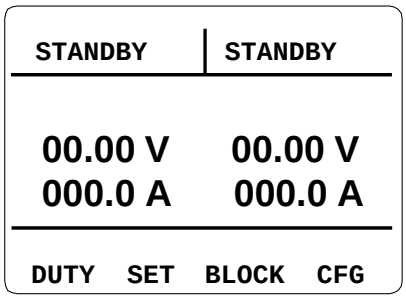


Setting for the unit to stop:
Use HOLD level or only light the ALARM LED when the set limit has been reached (option: contact to remote system) is set using the CFG/USER menu with the EOP MODE parameter.
NOTE that the settings also apply for the time limit. The CFG menu is password protected.

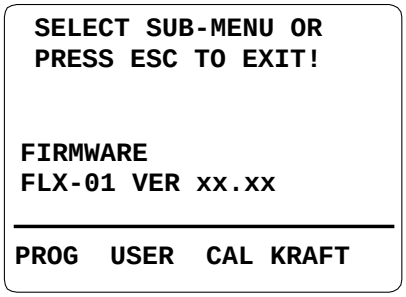
PARALLEL, SERIES

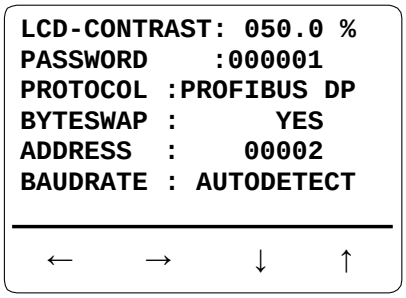


DUAL

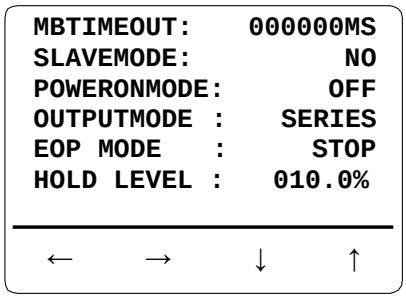


PARALLEL, SERIES

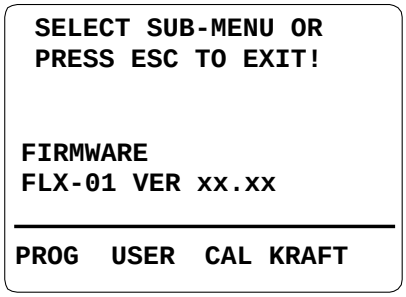


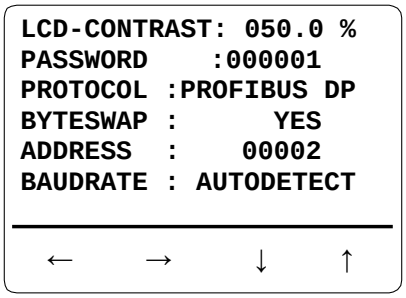


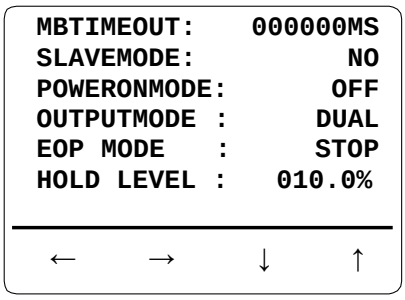
Press ↓ to get EOP MODE



DUAL







Press “OK” to activate change. Switch off the buzzer by pressing ESC

5.8.7.5 Setting the start ramp

The power supply can be set to ramp up voltage and current from zero to set value during a pre-set time. The time is set using the SET menu and the parameter START RAMP for both side A and side B.

PARALLEL, SERIES

```
STATUS: STANDBY

 00.00 V   000.0 A
000000 Ah  00000 S

DUTY  SET  BLOCK  CFG
```

```
REMOTE CONTROL : NO
SETVOLTAGE  : 00.00 V
SETCURRENT  : 000.0 A
RUN/BLOCK   :   RUN
START/STOP  :  STOP
TIMERLIMIT  :  -OFF- S

  ←     →     ↓     ↑
```

Press ↓ to get START RAMP

```
SETCURRENT  : 000.0 A
RUN/BLOCK   :   RUN
START/STOP  :  STOP
POLARITY    :   FWD
TIMERLIMIT  :  -OFF- S
AH-LIMIT    :  -OFF-AH

  ←     →     ↓     ↑
```

```
START/STOP  :  STOP
POLARITY    :   FWD
TIMERLIMIT  :  -OFF- S
AH-LIMIT A  :  -OFF-AH
AH-LIMIT B  :  -OFF-AH
START RAMP  : 0000.5 S
```

DUAL

```
STANDBY     | STANDBY

00.00 V     00.00 V
000.0 A     000.0 A

DUTY  SET  BLOCK  CFG
```

```
REMOTE CONTROL : NO
SETVOLTAGE A: 00.00 V
SETVOLTAGE B: 00.00 V
SETCURRENT A: 000.0 A
SETCURRENT B: 000.0 A
RUN/BLOCK   :   RUN

  ←     →     ↓     ↑
```

Press ↓ to get START RAMP

Press “OK” to activate change

5.8.7.6 Setting the remote control

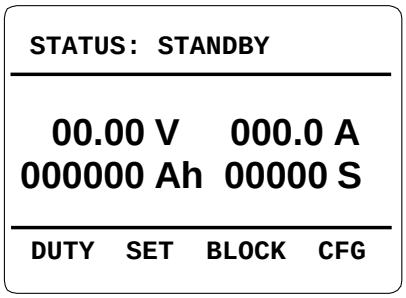
The unit can be remotely controlled by serial communication or analog signals. When the unit is remotely controlled, the local control is disabled. When controlled remotely, parameters that are controlled by the analog interface have precedence over parameters sent by serial communication.

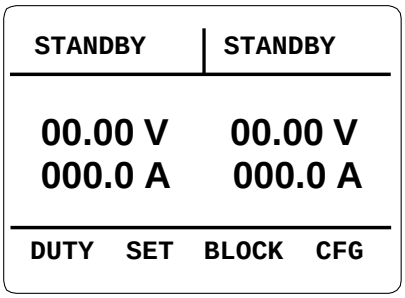
Special case: When using analog remote control, some set values and functions can be remotely controlled and others locally from the keypad, REMOTE=ON PROTOCOL=NONE. However it is possible to read out actual values The unit cannot be switched OFF with the OFF key. LOCAL mode must first be selected in the SET menu by setting REMOTE=NO.

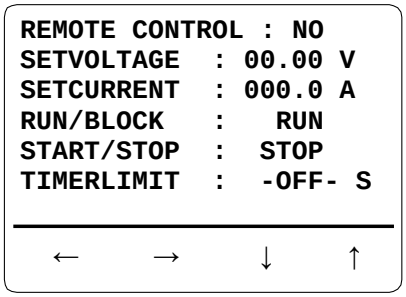
If the unit loses contact with the master during PROFIBUS control, the keypad will be re-activated.

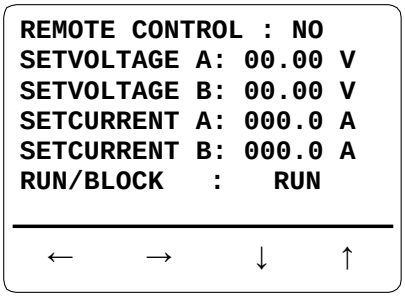
Remote control via serial communication is selected with the parameter REMOTE in the SET menu.

PARALLEL, SERIES DUAL









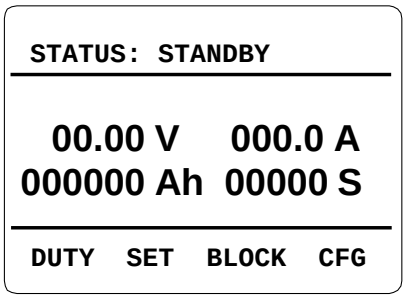
The parameters for remote control must to be set to provide correct remote control functionality.

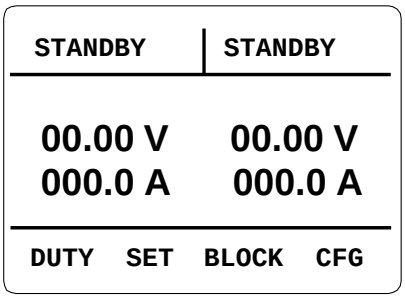
The protocol and parameters must be set for serial communication.
Use the CFG/USER menu (the menu is password protected).

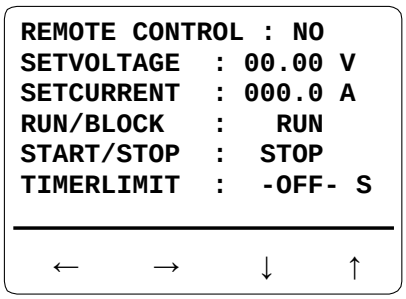
5.9 RUNNING A PROGRAM

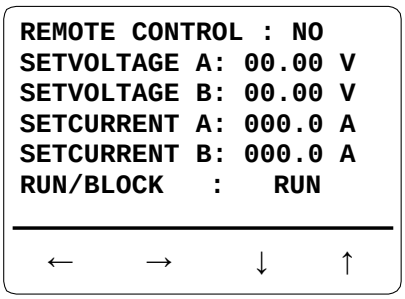
The program and operating mode are selected using the PROGRAMMODE and PROGRAM NO parameters in the SET menu.

PARALLEL, SERIES DUAL



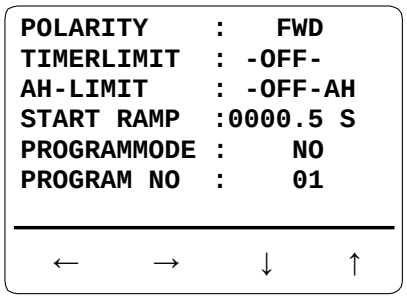




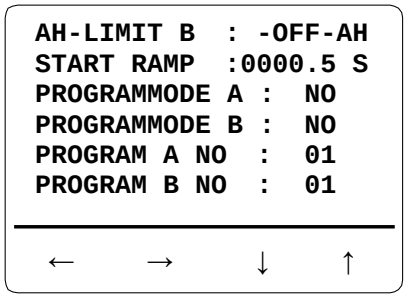


Press ↓ to get PROGRAMMODE Press ↓ to get PROGRAMMODE

PARALLEL, SERIES



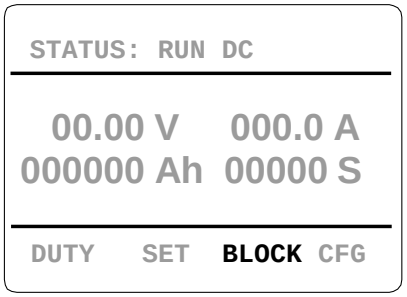
DUAL



Programs are entered using the CFG/PROG menu. The menu is password protected.

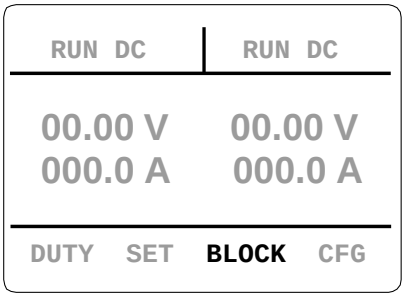
5.9.1 Pausing a program

PARALLEL, SERIES



Press ”BLOCK”

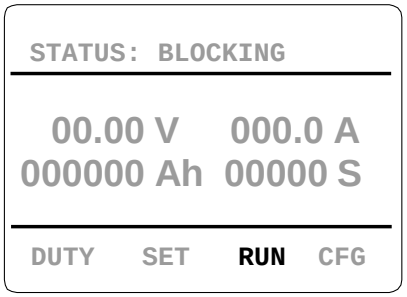
DUAL



Press ”BLOCK”

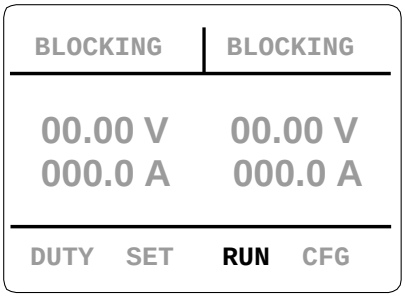
5.9.2 Restarting a paused program

PARALLEL and SERIES



Press “RUN”

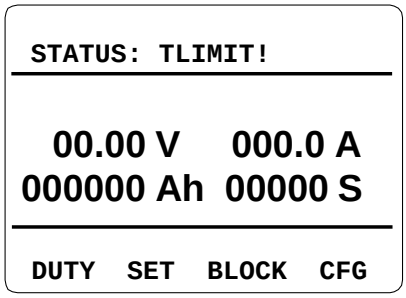
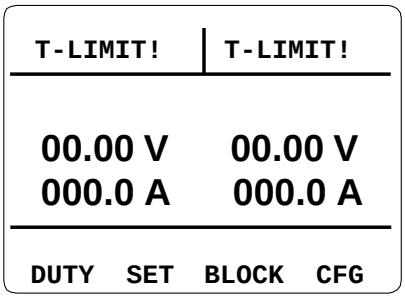
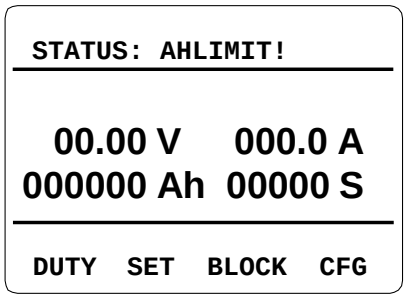
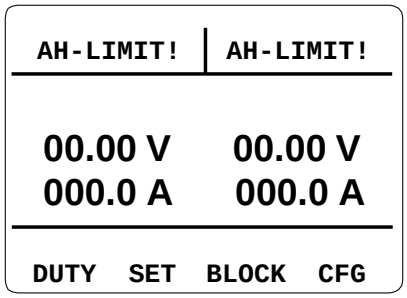
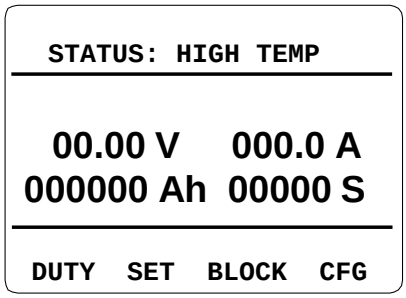
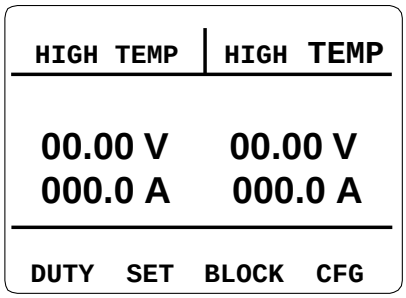
DUAL



Press “RUN”

5.9.3 Stopping the power supply

Switch the unit from “RUN” mode to “STANDBY” mode with the “OFF” key.
Shut down the power supply by pressing the “OFF” key again to switch from “STANDBY” mode to “OFF” mode.

	PARALLEL, SERIES	DUAL
Unit stops after set time.		
Unit stops after set number of Ah		
Unit stops due to excess temperature		

5.9.4 Blocking the unit RUN/BLOCK

The power supply can be blocked and stopped without entering “STANDBY”.
The blocking function turns the power supply output off and it restarts with the set values.
Use the “BLOCK” key, from the SET menu, or remote control.

5.9.5 Blocking the unit START/STOP

The power supply can be blocked and stopped without going to “OFF”.
The start function turns the power supply output off immediately and it restarts with a start ramp to the set values. Use the SET menu, or remote control.

6 CALIBRATION / CONFIGURATION

The power supply is calibrated and configured at the factory before delivery.
The power supply can also be calibrated by the customer from the CFG/CAL menu. The calibration menu is password protected.

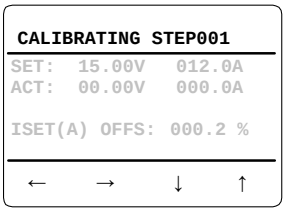
The power supply needs to be reconfigured if the DC output connection changes from parallel to series or vice versa.

6.1 CAL MENU

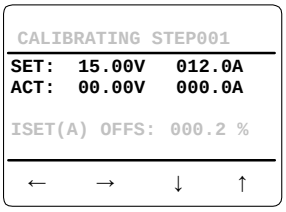
The calibration menu is password protected with the same password as the USER menu.
Calibration of the unit should be performed on a regular basis depending on the type of operation once a year.
The unit has a built-in calibration table. See the menu CFG/CA. When calibrating, external calibrated current and voltage measuring devices with sufficient accuracy for the process are connected.
If the power supply outputs are reduced in relation to the rated capacity, calibration should be performed.

Requisite equipment includes instruments for voltage and current measurement. For the DC current, a current sensor, a shunt or a contact free measuring device is required (Clamp-on ammeter for DC).

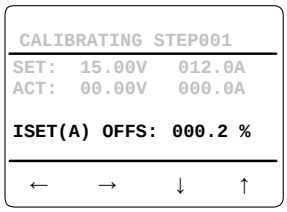
Explanation of the calibration menu



Shows the calibration step



Shows the actual and set value for this calibration step



Shows value and type to be calibrated

When calibrating SET values, adjust with arrows ← → until the external instrument shows the set value on the display.
When calibrating ACT values, adjust with arrows ← → until the ACT value shows the set value on the display.
The values on the displays vary with the number of power modules.

When calibrating SET values, adjust with arrows ← → until the external instrument shows the set value on the display.
When calibrating ACT values, adjust with arrows ← → until the ACT value shows the set value on the display.
The values on the displays vary with the number of power modules.

7 PROGRAMMING

7.1 Signal names and explanations

In the unit's control system a number of signals are used. An explanation of some of the names is given below.

ON/OFF	The unit is blocked and the display is turned off and the AC breaker deactivated.
START/STOP	The unit is blocked and started with a starting ramp. Restarts any program that is running.
BLOCK/RUN	The unit is blocked and started without a starting ramp.
RESTART	Time and Ah counters are reset and restarted.
POWERGOOD	Signal that indicates that the unit is functioning and supplying current, or is ready to supply current.
ALARM	Fault signal from the unit.
PROCESS END	Signal that indicates that the conditions for PROCESS END is fulfilled.
AUTODOSING	Signal to the dosing system.
PULSELENG.	Length of signal to dosing system.
POWER ON	The unit is ON.
AUX IN A-B	Customer input, to read a digital signal, for example, a limit switch. The signal comes from a DIG IN input and reads through serial communication.
AUX OUT A-B	Customer output for control of equipment. The signal goes to a DIG OUT and comes from serial communication.
DIG IN 1-4	Name on physical digital input
DIG OUT 1-4	Name on physical digital output
ANA IN 1-4	Name on physical analog input.
ANA OUT 1-4	Name on physical analog output.

7.2 General

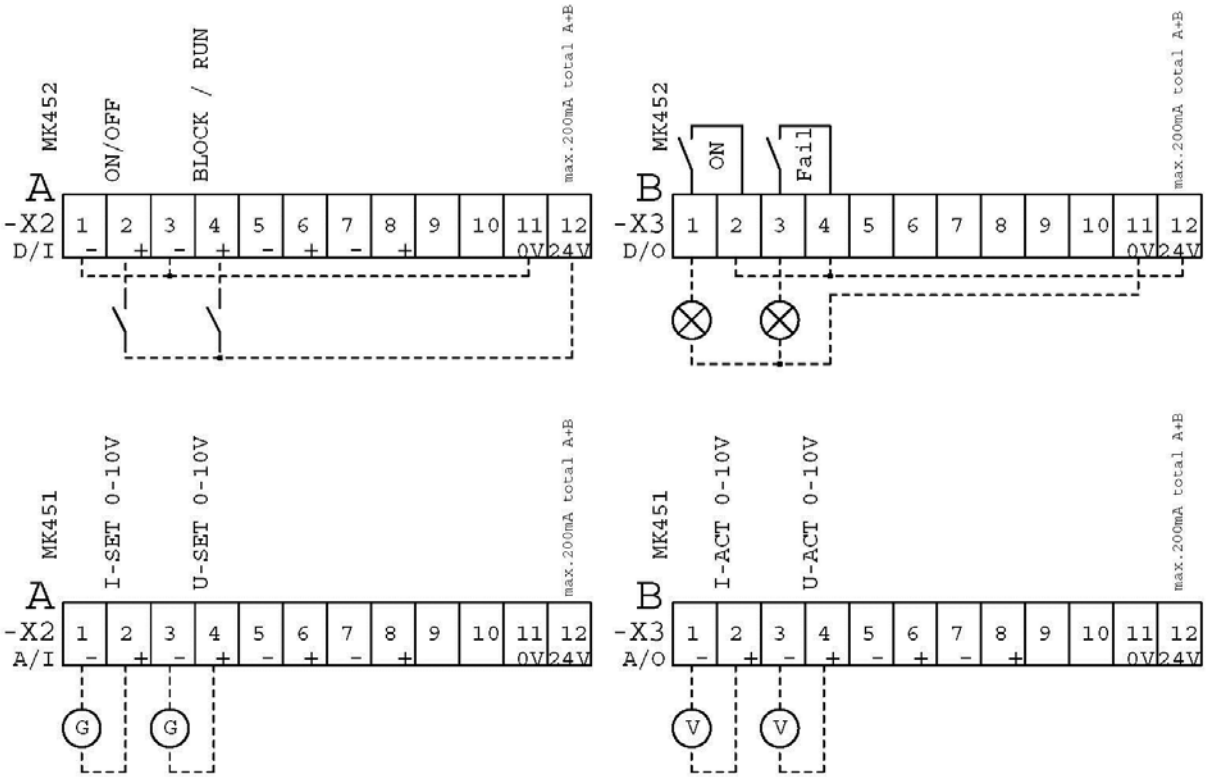
The 'POWERONMODE' parameter in the CFG/USER submenu is set to REMOTE if the power supply must always start in remote control mode when switched on.
Before the unit can be remotely controlled it must be set to REMOTE Mode.
All parameters can be read even if the unit is in LOCAL Mode and is being controlled manually.

When the unit is set to REMOTE, no parameters can be changed locally on the keypad.

7.3 Analog control (OPTION)

The function is implemented on a PCB located behind the cover plate for control signals at the rear of the control module.

Analog & Digital Input and Output connections (Potential free / floating)



Inputs and outputs are galvanically insulated, maximum 50V difference, between the unit and external control system, and between channels.

The unit's set points for current and voltage can be controlled by analog signals: 0-20 mA, 4-20 mA or by 0-10VDC, 0-5VDC, 6-0VDC or 10-0VDC.

The unit's actual values for current and voltage can be obtained using analogue signals: 0-20 mA, 4-20 mA or by 0-10VDC, 0-5VDC, 6-0VDC or 10-0VDC.

The 20 mA and 10V (for 0-10VDC control) signals represent the maximum output current/voltage of the unit. If the unit output is limited these correspond to the set maximum values.

NOTE! The current and voltage control signals for set values and actual values cannot be mixed. The PCB is differently assembled for voltage or current set point/actual signals. Setting of 0-20mA, 4-20mA or 0-10V, 0-5VDC, 6-0VDC or 10-0VDC is done in the software in the CFG/USER menu.

Settings are made with the following parameters: ANA IN 1 to ANA IN 4, ANA OUT 1 to ANA OUT 4 in the CFG/USER menu

NOTE! If the unit is set for analog/digital (by switches) remote control of parameters, these values have priority over those from serial communication.

Functions that have not been configured for remote control are locally controlled from the keyboard.

Analog programming - technical data
Max insulation voltage 50V

Analog signals:	Input signals 0-10VDC input impedance >10kΩ Output signals 0-10VDC min load impedance 500Ω or Input signal 0(4)-20mA Output signals 0(4)-20mA, maximum 10V@20mA NOTE: Voltage and current signals require different PCBs, and cannot be used simultaneously.
+24VDC	Max load each output and total PCB 200mA +24VDC floating potential relative to rectifier output

7.4 Digital I/O

The function is implemented on a PCB located behind the cover plate for control signals at the rear of the control module.
Inputs and outputs are galvanically insulated.

The unit's current and voltage set points can also be controlled with increase/decrease contacts.

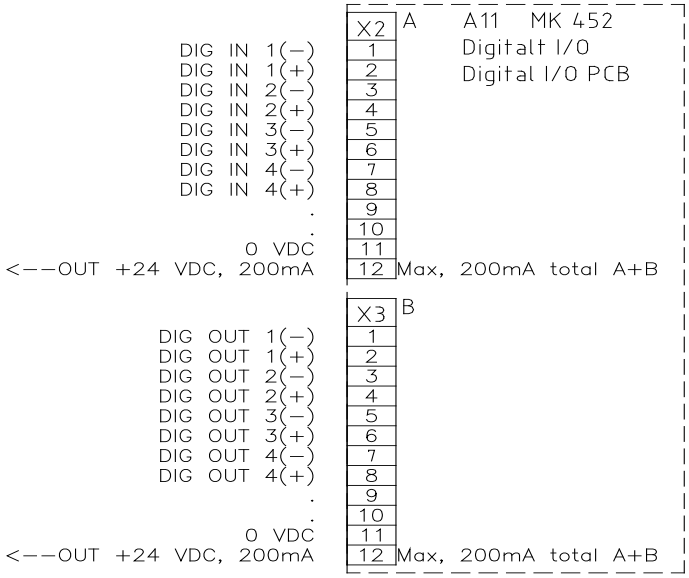
The functions ON/OFF, START/STOP, BLOCK/RUN or RESTART can be controlled via (NO) contacts. Please observe that the circuit must contain a voltage source.

The unit has two customer programmable inputs and two outputs. The outputs function both in local and remote modes, inputs function only in remote mode.
Serial communication RS-485 or serial communication RS-232 must be installed for customer programmable inputs and outputs.

Settings are made with the following parameters: DIG IN 1 to DIG IN 4, DIG OUT 1 to DIG OUT 4, in the CFG/USER menu.
NOTE: If the unit is set for analog/digital (by switches) remote control of parameters, these values have priority over those from serial communication.

Parameters that have not been configured for remote control are locally controlled from the keyboard.

7.4.1 Connection



+24V is the supply from the board. This voltage is intended to drive digital inputs in the using external zero potential switches, or for driving optocouplers in a PLC unit, for example, using zero potential switches where no external supply is available for the signal.

If the unit is delivered with the PCB assembled it is configured as below. See the label on the inside of the plate through which the control cables pass at the rear of the control module for the supplied configuration.

	PARALLEL, SERIES	DUAL
DIG IN 1:	ON/OFF	ON/OFF
DIG IN 2:	START/STOP	START/STOP
DIG IN 3:	NONE	START/STOP A
DIG IN 4:	NONE	START/STOP B
DIG OUT 1:	POWER ON	POWER ON
DIG OUT 2:	ALARM	ALARM
DIG OUT 3:	NONE	NONE
DIG OUT 4:	NONE	NONE

In series and parallel mode, control signals for (A) are valid, control signals for (B) are deactivated

Digital inputs: The function or the first of two functions (**ON**/OFF) are active when current flows in the input.

Digital outputs: When the function is true the output is high, or in the case of relay control, the relay contact is closed.

See labels on the back of the control module for PCB placement and configuration.

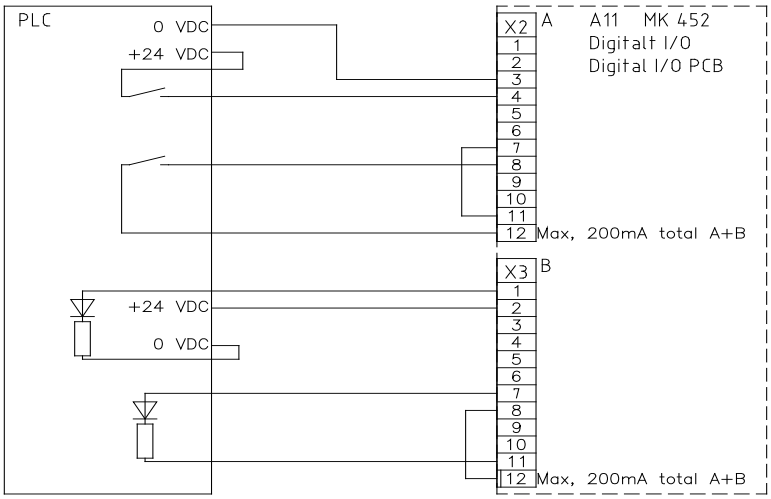
7.4.2 Wiring example

Input signals:

X2:3 and 4 supplied from external voltage supply.
X2:7 and 8 supplied from PCB internal voltage supply

Output signal:

X3:1 and 2 to PLC - input supplied from external voltage supply.
X3:7 and 8 to PLC - input supplied from PCB internal voltage supply.



7.4.3 Digital I/O - technical data

Max insulation voltage 50V

Digital signals: Input current 15 mA@24VDC non polarized, recommended polarization
Output contacts: 24VAC 1 A; or 24VDC 1A L/R 48ms
Minimum contact load 100mA 12V for reliable operation.

If the load is inductive the relay contacts must be protected against sparks. This is done for example with a RC snubber, or in the case of DC, a freewheel diode across the load. Take care about diode polarity.

+24VDC Max load each output and total PCB 200mA@24VDC
+24VDC floating potential relative to unit output.
This voltage is intended to feed input signals coming from voltage free contacts

7.5 SERIAL COMMUNICATION

Control via RS 485 (Profibus or Modbus). Re-configuration can be made in menu CFG/USR.

Example:

Serial communication from PROFIBUS DP

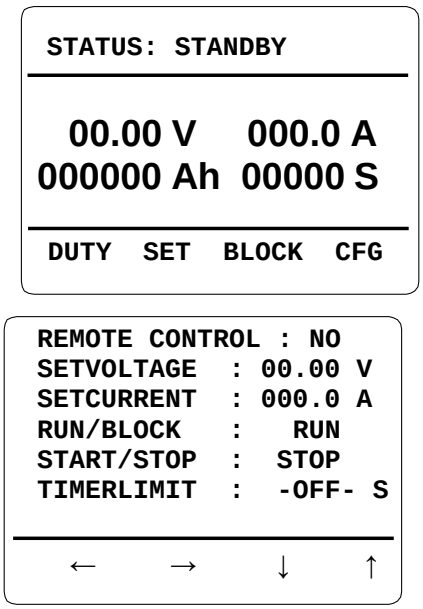
-Access menu CFG/USR
-Browse with ↑ ↓ keys until PROTOCOL is marked
-Browse with ← → keys until PROFIBUS DP is visible on the display
-Set ADDRESS, BAUDRATE (normally auto) and, if needed, BYTESWAP
-Press the OK key.
-Go to the SET menu, see section 5.2.7.
-Browse with ↑ ↓ keys until REMOTE CONTROL is marked
-Browse with ← → keys until YES is visible on the display
-Press the OK key

7.6 SETTING THE REMOTE CONTROL

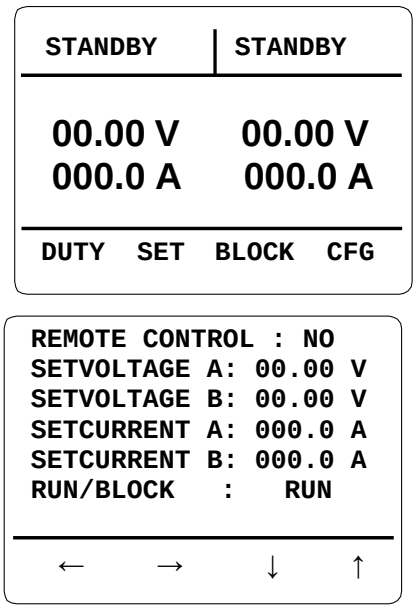
The unit can be remotely controlled by serial communication. When the unit is remotely controlled, the local control is disabled. When controlled remotely, parameters that are controlled by the analog interface have precedence over parameters sent by serial communication.
Special case: When using analog remote control, some set values and functions can be remotely controlled and others locally from the keypad, REMOTE=ON PROTOCOL=NONE. However it is possible to read out actual values The unit cannot be switched OFF with the OFF key. LOCAL mode must first be selected in the SET menu by setting REMOTE=NO.
If the unit loses contact with the master during PROFIBUS control, the keypad will be re-activated.

Remote control via serial communication is selected with the parameter REMOTE in the SET menu.
The parameters for remote control must to be set to provide correct remote control functionality.
The protocol and parameters must be set for serial communication.
Use the CFG/USER menu (the menu is password protected).

PARALLEL, SERIES



DUAL



7.7 PROFIBUS DP

Technical data:
Serial interface:**, RS-485 alternatively RS-232**
Baud rate: max 12Mbps, auto-detect
Maximum number of nodes on the bus: 32 (1 controller and 32 power supplies)

It is important to use a cable that is intended for communication by RS-485 (twisted pair, screened). For Profibus, approved Profibus cable must be used. The Profibus cable must be terminated at both ends. If the wiring is not correctly installed, the serial communication may stop working. It is important to use a cable that is intended for communication by RS-485 (twisted pair, screened).
Transmission errors are detected and dealt with by the software.

For the power supply to be able to communicate, it must be configured in the CFG/USER submenu. The protocol must be chosen and the unit must be given an address. Depending on the type of PLC, the BYTESWAP function may have to be activated.
Each register contains 16 bits, which are divided into two, eight-bit parts when the content is sent over the serial link. The order of these eight-bit parts can be changed with the BYTESWAP function.

7.8 Control via RS 485

This function is implemented on a PCB located behind the cover plate for control signals at the rear of the control module.
One or several units can be controlled via RS-485 serial communication.
The data bus from the control unit is daisy-chained between the units. On the last unit the termination resistors are switched on, DIP switch A4:S1=ON. The termination minimises disturbances on the data bus, avoiding communication problems. On the other units the termination resistors is disconnected,
DIP switch A4:S1=OFF
Protocol MODBUS RTU or PROFIBUS DP.

7.9 Control via RS-232

The function is implemented on a PCB located behind the cover plate for control signals at the rear of the control module.
One unit can be controlled via RS-232 serial communication. The protocol is set in CFG/USER menu

The power supply is controlled with Profibus via data exchange.
The data is described in 9.2.1 Overview of registers (next page)

Internet links: For further information about the Profibus protocol, use the following links. http://www.profibus.com http://www.sea.siemens.com/

7.9.1 Overview of registers

GSD-File *krft094b.gsd*
SubModule ***Std***
Cfg *0x5f 0x51 0x68*

Output Mode: Series or Parallel							
PLC						**Use**	
Reg.No	**R/W**	**Name**	**Type**	**Multiplier**	**Description**	**Default**	**Range**
0	R/W	PageNo	Unsigned 16bit		Reserved	0	0
1	R/W	Controlregister	Unsigned 16bit		Controls On/Off, Start/Stop etc. See below	0	0 - 65535
2	R/W	Set Voltage	Signed 16bit	*0,01V	Set Voltage	0	0 - (Rated Voltage*100)
3	R/W	Set Current	Signed 16bit	*1A/*0.1A	Set Current	0	0 - Rated Current (2)
4	R/W	Process Timer Limit High Word	Unsigned 16bit	*65535 s	Pre-set for process timer. High Word	0	0 - 999999
5	R/W	Process Timer Limit Low Word	Unsigned 16bit	*1 s	Pre-set for process timer. Low Word	0	
6	R/W	Ah-Limit High Word	Unsigned 16bit	*65536Ah	Pre-set for Ah-Counter. High Word	0	0 - 999999
7	R/W	Ah-Limit Low Word	Unsigned 16bit	*1Ah	Pre-set for Ah-Counter. Low Word	0	
8	R/W	Startramp	Unsigned 16bit	*0.1 s	Initial start ramp after activation of start bit	0	0-30000
9	R	StatusRegister	Unsigned 16bit		Bit register, Indicates status of unit. See below	0	0 - 65535
10	R	WarningsRegister	Unsigned 16bit		Bit register, Indicates warnings. See below	0	0 - 65535
11	R	AlarmsRegister	Unsigned 16bit		Bit register, Indicates alarms. See below	0	0 - 65535
12	R	Output Voltage	Signed 16bit	*0,01V	Output Voltage	0	-30000 - 30000
13	R	Output Current	Signed 16bit	*1A/*0.1A	Output Current	0	-30000 – 30000 (1)
14	R	Process Time High Word	Unsigned 16bit	*65536 s	Number of seconds elapsed since Reset of Process Timer. High Word	0	0 - 999999
15	R	Process Time Low Word	Unsigned 16bit	*1 s	Number of seconds elapsed since Reset of Process Timer. Low Word	0	
16	R	Ah High Word	Unsigned 16bit	*65536 Ah	Number of Ah since Reset of Ah-Counter. High Word	0	0 - 999999
17	R	Ah Low Word	Unsigned 16bit	*1Ah	Number of Ah since Reset of Ah-Counter. Low Word	0	

Registers 1-8 are set values
Registers 9-17 are actual values

GSD-File *krft094b.gsd*
SubModule ***Std dual***
Cfg *0x5f 0x59 0x6c*

Output Mode: Dual							
PLC						**Use**	
Reg.No	**R/W**	**Name**	**Type**	**Multiplier**	**Description**	**Default**	
0	R/W	PageNo	Unsigned 16bit		Reserved	0	0
1	R/W	Controlregister	Unsigned 16bit		Controls On/Off, Start/Stop etc. See below	0	0 - 65535
2	R/W	Set Voltage A	Signed 16bit	*0,01V	Set Voltage A-Side	0	0 - (Rated Voltage*100)
3	R/W	Set Current A	Signed 16bit	*1A/*0.1A	Set Current A-Side	0	0 - Rated Current (2)
4	R/W	Set Voltage B	Signed 16bit	*0,01V	Set Voltage B-Side	0	0 - (Rated Voltage*100)
5	R/W	Set Current B	Signed 16bit	*1A/*0.1A	Set Current B-Side	0	0 - Rated Current (2)
6	R/W	Process Timer Limit High Word	Unsigned 16bit	*65535 s	Pre-set for process timer. High Word	0	0 - 999999
7	R/W	Process Timer Limit Low Word	Unsigned 16bit	*1 s	Pre-set for process timer. Low Word	0	
8	R/W	Ah-Limit A High Word	Unsigned 16bit	*65536Ah	Pre-set for Ah-Counter A- Side. High Word	0	0 - 999999
9	R/W	Ah-Limit A Low Word	Unsigned 16bit	*1Ah	Pre-set for Ah-Counter A- Side. Low Word	0	
10	R/W	Ah-Limit B High Word	Unsigned 16bit	*65536Ah	Pre-set for Ah-Counter B- Side. High Word	0	0 - 999999
11	R/W	Ah-Limit B Low Word	Unsigned 16bit	*1Ah	Pre-set for Ah-Counter B- Side. Low Word	0	
12	R/W	Startramp	Unsigned 16bit	*0.1 s	Initial start ramp after activation of start bit	0	0-30000
13	R	StatusRegister	Unsigned 16bit		Bit register, Indicates status of unit. See below		0 - 65535
14	R	WarningsRegister	Unsigned 16bit		Bit register, Indicates warnings. See below		0 - 65535
15	R	AlarmsRegister	Unsigned 16bit		Bit register, Indicates alarms. See below		0 - 65535
16	R	Output Voltage A	Signed 16bit	*0,01V	Output Voltage A-Side		-30000 - 30000
17	R	Output Current A	Signed 16bit	*1A/*0.1A	Output Current A-Side		-30000 – 30000 (1)
18	R	Output Voltage B	Signed 16bit	*0,01V	Output Voltage B-Side		-30000 - 30000
19	R	Output Current B	Signed 16bit	*1A/*0.1A	Output Current B-Side		-30000 – 30000 (1)
20	R	Process Time High Word	Unsigned 16bit	*65536 s	Number of seconds elapsed since Reset of Process Timer. High Word		0 - 999999
21	R	Process Time Low Word	Unsigned 16bit	*1 s	Number of seconds elapsed since Reset of Process Timer. Low Word		
22	R	Ah High Word A	Unsigned 16bit	*65536 Ah	Number of Ah for A-side since Reset of Ah- Counter. High Word		0 - 999999
23	R	Ah Low Word A	Unsigned 16bit	*1Ah	Number of Ah for A-side since Reset of Ah- Counter. Low Word		
					Number of Ah for B-		

24	R	Ah High Word B	Unsigned 16bit	*65536 Ah	side since Reset of Ah- Counter. High Word		0 - 999999
25	R	Ah Low Word B	Unsigned 16bit	*1Ah	Number of Ah for B-side since Reset of Ah- Counter. Low Word		

Registers 1-12 are set values, Registers 13-25 are actual values

7.9.2 Bit registers: Control register

R/W	Register	1	0	Function
R/W	Controlregister bit00	On	Off	Turn the unit on or off
R/W	Controlregister bit01	Start A	Stop A	Start or stop process for A-side
R/W	Controlregister bit02	Block A	Run A	Pause process for A-side
R/W	Controlregister bit03	Run prog A		Program Run A-side
R/W	Controlregister bit04	Reverse Current A Side		Pole reverse A-side
R/W	Controlregister bit05	Reverse Current B Side		Pole reverse B-side
R/W	Controlregister bit06			
R/W	Controlregister bit07	Start B	Stop B	Start or stop process for B-side
R/W	Controlregister bit08	Clear Ah A		Clear Ah counter A-side
R/W	Controlregister bit09	Clear Ah B		Clear Ah counter B side
R/W	Controlregister bit10	Clear Timer		Clear process timer
R/W	Controlregister bit11			
R/W	Controlregister bit12	Block B	Run B	Pause process for B-side
R/W	Controlregister bit13	Auxiliary Out A		Programmable Digital Output A
R/W	Controlregister bit14	Auxiliary Out B		Programmable Digital Output B
R/W	Controlregister bit15	Run prog B		Program Run B

7.9.3 Bit registers: Status register

R/W	Register	1	0	Function
R	Statusregister b00	Alarm	No Alarm	The cause of alarm is to be found in the Alarms register
R	Statusregister b01	Warning	No Warning	The cause of warning is to be found in the Warnings register
R	Statusregister b02	Remote	Local	When in local, unit can not be controlled by serial bus
R	Statusregister b03	Running A	Not running A	if Running, unit is working according to set parameters A
R	Statusregister b04	Ah A>Ah-Limit A	Ah A<Ah-Limit A	Shows if pre-set Ah-Limit is reached. (A-side if dual output).
R	Statusregister b05	Ah B>Ah-Limit B	Ah B<Ah-Limit B	Shows if pre-set Ah-Limit is reached. (B-side if dual output).
R	Statusregister b06	Timer>TimerLimit A	Timer<TimerLimit A	Shows if pre-set Process Timer Limit is reached A-side
R	Statusregister b07	Voltage Mode A	Current Mode A	Shows if A-Side is running in Voltage Mode. Load Impedance may be too high.
R	Statusregister b08	Voltage Mode B	Current Mode B	Shows if B-Side is running in Voltage Mode. Load Impedance may be to high.
R	Statusregister b09	On or StandBy	Off	Status of unit (Same as green LED on display)
R	Statusregister b10	Current Hires	Current normal	The bit is set if the resolution for current registers are 0.1A. (1), (2)
R	Statusregister b11	Running B	Not running B	if Running, unit is working according to set parameters B
R	Statusregister b12	Timer>TimerLimit B	Timer<TimerLimit B	Shows if pre-set Process Timer Limit is reached B-side
R	Statusregister b13	Auxiliary In A active		Programmable Digital Input A
R	Statusregister b14	Auxiliary In B active		Programmable Digital Input B
R	Statusregister b15			

(1) When reading actual current, divide by 10 if Hires, status register 10; is activated
(2) When writing set current, multiply by 10 if Hires, status register 10; is activated

7.9.4 Bit registers: Warning register

R/W	Register	1	0	Function
R	Warningsregister b00			
R	Warningsregister b01			
R	Warningsregister b02			
R	Warningsregister b03	Activated	OK	Alarm from pole reverser A
R	Warningsregister b04	Activated	OK	Alarm from pole reverser B
R	Warningsregister b05	Activated	OK	Unit delivers maximum power
R	Warningsregister b06	Activated	OK	Illegal Parameter. One or more parameters are in conflict. Check Parameters.
R	Warningsregister b07	Activated	OK	High temp warning. One or more power-modules have shut down, or will do shortly
R	Warningsregister b08			
R	Warningsregister b09			
R	Warningsregister b10	Activated	OK	Unit fails to deliver requested output power. May be due to mains fault.
R	Warningsregister b11			
R	Warningsregister b12			
R	Warningsregister b13			
R	Warningsregister b14			
R	Warningsregister b15			

7.9.5 Bit registers: Alarm register

R/W	Register	1	0	Function
R	Alarmsregister b00	Activated	OK	Internal temperatures too high. Unit has shut down. Check cooling.
R	Alarmsregister b01			
R	Alarmsregister b02	Activated	OK	Critical error on one or more power modules. May need service.
R	Alarmsregister b03	Activated	OK	Alarm Ext A
R	Alarmsregister b04	Activated	OK	Alarm Ext B
R	Alarmsregister b05	Activated	OK	Polarity control. Fault in CFG of pole reverse
R	Alarmsregister b06	Activated	OK	External alarm 1
R	Alarmsregister b07			
R	Alarmsregister b08			
R	Alarmsregister b09			
R	Alarmsregister b10			
R	Alarmsregister b11			
R	Alarmsregister b12			
R	Alarmsregister b13			
R	Alarmsregister b14			
R	Alarmsregister b15			

7.9.6 Programming examples

The rectifier is controlled from a Profibus master (PC or PLC), parallel output.
Control the unit as follows:

1. Start the unit by writing 3 to register 1
2. Set the voltage by writing to register 2
3. Set the current by writing to register 3

Operation is supervised by reading registers 9, 12 and 13.

7.9.7 Troubleshooting Profibus communication

If communication cannot be established:

- Check that the unit is in Remote mode (yellow LED on front panel).
- Check that the unit has the correct address.
- Check that the cable is correctly terminated. (terminated at the last device in the loop)
- Try reversing the polarity of the field bus cable.
- Check that the correct sub-module has been selected in the .GSD file.
- Go into the Duty menu and check DP-State. When communication is working as it should, 'Data Exchange' should be displayed. If 'Wait prm' is displayed, no contact has been established.
- Check that there are not two devices with the same address on the field bus.
- Check that the remote control inputs are configured correctly.

The status of Profibus communication can be found in the DUTY submenu.

WD state	Watchdog state machine:
Baud Search state	The device listens to the serial bus and attempts to determine the baud rate with autodetect
Baud Control	Baud rate determined, ready to communicate.
DP Control	Communicating

DP State	DP State machine:
Wait Prm	Waiting for parameterisation data from Profibus Master.
Wait Cfg	Waiting for configuration data from Profibus Master.
Data Exchange	Running OK, data is being exchanged between the unit and Profibus Master.

Register content of control register and status register is also available. Use it to check that reading and writing from/to registers is working.

There is no need to set the baud rate for Profibus communication. The unit automatically detects the baud rate between 9600 bps and 12Mbps.

The unit sends low byte first (default). High byte can be sent first if required, by activating the BYTESWAP function.

If communication is working but the r unit is not being properly controlled:

- Try changing BYTESWAP in the CFG/USER menu.

7.9.8 GSD file

The GSD file describes how data are to be sent with the Profibus protocol.
Depending on how the unit is configured, one of several 'submodules' must be chosen:

- When the outputs are connected in series or parallel.
- When the outputs are controlled individually.

7.9.9 Tips

Communication information can be read on DUTY menu.
There are 16 bits in each register. For transfer on the fieldbus the register is divided into two eight-bit words. Which word is sent first is determined by Hi byte or Low byte, using the BYTESWAP setting. This is different for different makes of PLC. Siemens often requires that Byteswap is activated, While Japanese PLCs often require that Byteswap is OFF.

7.10 MODBUS RTU

Technical data:
Serial interface**: RS-232 alternative RS-485**
Interface: RS-232
Baud rates: 4800, 9600, 19200, 38400 bit/s
Data length 8 bits
Parity Even
Stop bits 1 bit
Maximum number of nodes on the bus: 1

Interface: RS-485
Baud rate:4800, 9600, 19200, 38400 bit/s
Maximum number of nodes on the bus: 32 (1 controller and 31 rectifiers). The system tends to be slower with more than 10 nodes.
Recommended RS-232/RS-485 converter: Westermo MA-45.

Modbus-specific data

Address range	1-247
Functions	F01, 02, 03, 04, 05, 06, 16
Broadcast support	Yes
Turn around delay	4.5 character time, or as defined in MBTimeout.

7.10.1 Control

Modbus RTU is a simple and efficient protocol which is easy to implement on most platforms. It is used world wide. Data can be sent and received as single bits, whole words or several words in one command.
Messages contain little overhead and are relatively secure as a result of using checksums and timeout.

A typical control sequence might look like this:
1. Read actual values from the unit r with Modbus command F04
2. Process data
3. Send new settings to the unit with Modbus command F16
4. Go to step 1

If PC software is running under Windows, timeout errors will probably occur during communication with the Modbus RTU. This can be avoided by using the MBTimeOut parameter. The actual value needs to be tested on each individual installation.
It is important that the serial communication settings are the same for all connected devices. Recommended baud rate: 38400 bit

Internet links
For further information about the Modbus protocol, use the following links.

www.modbus.org www.westermo.se

7.10.2 Overview of registers

Modbus RTU

Communication Parameters	
Protocol	Modbus
Baudrates	4800, 9600, 19200, 38400 kbps
Start bits	1 bit
Least significant bit sent first	
Data lenght	8 bits
Parity	Even
Stop bits	1 bit
Supported Functions	F01, 02, 03, 04, 05, 06, 16
Address Range	1 - 247
Broadcast supported	Yes

Note1: The entire message frame must be
transmitted as a continuous stream of characters
If a silent interval of more than 1.5 character times occurs between two characters, the message is declared incomplete and is discarded
If the master device is a PC running Windows, this can be difficult to achieve, thus there is a setting on the Cfg/User menu, MBTimeout, which can be used to increase this time. This will also lower communication rate slightly.

Note2: It is important that the master device waits for >3.5 character times after a response, before sending a new request. Note3: Modbus ASCII is not supported.
Note4: Most PLCs start the addressing range with adress 1, PC-software often start with adress 0. Be careful with this…

Modbus functions	**Name**	**Note**
F01	Read Coil Status	Use to read back previously set bits in Controlregister (setvalues)
F02	Read Input Status	Use to read bits set in status registers (actual values)
F03	Read Holding registers	Use to read back previously set registers (setvalues)
F04	Read Input Registers	Use to read registers (actual values)
F05	Force Single Coil	Use to set single bit in Controlregister
F06	Pre-set Single Register	Use to set register
F16	Pre-set Multiple Registers	Use to set multiple registers

7.10.3 Modbus Parameter list

Digital Set values

PLC	PC						Use	
Coil No.	Coil No.	R/W	Name	1	0	Description	Default	
00017	16	R/W	On/Off	On	Off	0 - Off, 1- On	0	Controlregister
00018	17	R/W	Start/Stop A	Start	Stop	0 – Stop A, 1 – Start A	0	Controlregister
00019	18	R/W	Block/Run A	Block	Run	0 – Run A, 1- Block A	0	Controlregister
00020	19	R/W	Run Prog A			Program Run A-side	0	Controlregister
00021	20	R/W	Reverse Current A Side			Pole reverse A-side	0	Controlregister
00022	21	R/W	Reverse Current B Side			Pole reverse B-side	0	Controlregister
00023	22	R/W					0	Controlregister
00024	23	R/W	Start/Stop B	Start B	Stop B	Start or stop process for	0	Controlregister
00025	24	R/W	ClrAhA	Clear	Count	1 - Clear AhCounter A	0	Controlregister
00026	25	R/W	ClrAhB	Clear	Count	1 - Clear AhCounter B	0	Controlregister
00027	26	R/W	ClrTimer	Clear	Count	1 - Clear Process	0	Controlregister
00028	27	R/W					0	Controlregister
00029	28	R/W	Block B	Block	Run	Pause process for B-side	0	Controlregister
00030	29	R/W	Auxiliary Out A			Programmable Digital Output A	0	Controlregister
00031	30	R/W	Auxiliary Out B			Programmable Digital Output B	0	Controlregister
00032	31	R/W	Run Prog B			Program Run B-side	0	Controlregister

Digital Actual values

PLC	PC						
Input No.	Input No.	R/W	Name	1	0	Description	Note
10017	16	R	AlarmPresent	Alarm	No Alarm	The cause of alarm is to be found in the Alarms register	Statusregister b00
10018	17	R	WarningPresent	Warning	No Warning	The cause of warning is to be found in the Warnings register	Statusregister b01
10019	18	R	Remote/Local	Remote	Local	When in local, unit can not be controlled by serial bus	Statusregister b02
10020	19	R	Running A	Running	Not running	if Running, unit is working according to set parameters A-side	Statusregister b03
10021	20	R	AhLimitAReachedA	Ah A>Ah-Limit A	Ah A<Ah-Limit A	Shows if pre-set Ah-Limit is reached. (A-side if dual output)	Statusregister b04
10022	21	R	AhLimi tBReachedB	Ah B>Ah-Limit B	Ah B<Ah-LimitB	Shows if pre-set Ah-Limit is reached. (B-side if dual output)	Statusregister b05
10023	22	R	ProcessTimerLimit Reached A	Timer A> TimerLimit A	Timer A< TimerLimit A	Shows if pre-set Process Timer Limit is reached A	Statusregister b06
						Shows if A-Side is running in Voltage Mode.	

10024	23	R	C/V-mode A	Voltage Mode	Current Mode	Load Impedance may be to high.	Statusregister b07
10025	24	R	C/V-mode B	Voltage Mode	Current Mode	Shows if B-Side is running in Voltage Mode. Load Impedance may be to high.	Statusregister b08
10026	25	R	On	On or StandBy	Off	Status of unit (Same as green LED on display)	Statusregister b09
10027	26	R	Current HiRes	Current Hires	Current normal	The bit is set if the resolution for current registers are 0.1A.	Statusregister b10
10028	27	R	Running B	Running	Not running	if Running, unit is working according to set parameters B-side	Statusregister b11
10029	28	R	ProcessTimerLimitReachedB	Timer B> TimerLimit B	Timer B< TimerLimit B	Shows if pre-set Process Timer Limit is reached B	Statusregister b12
10030	29	R	Aux In A	Auxiliary In A active		Programmable Digital Input A	Statusregister b13
10031	30	R	Aux In B	Auxiliary In B active		Programmable Digital Input B	Statusregister b14
10032	31	R					Statusregister b15
10033	32	R					Warningsregister b00
10034	33	R					Warningsregister b01
10035	34	R					Warningsregister b02
10036	35	R	External Alarm A	Activated	OK	Alarm from pole reverser A	Warningsregister b03
10037	36	R	External Alarm B	Activated	OK	Alarm from pole reverser B	Warningsregister b04
10038	37	R	Maximum Power	Activated	OK	Unit delivers maximum power	Warningsregister b05
10039	38	R	IllegalParam	Activated	OK	Illegal Parameter. One or more parameters are in conflict. Check Parameters.	Warningsregister b06
10040	39	R	HighTemp	Activated	OK	High temp warning. One or more power-modules have shut down, or will do shortly	Warningsregister b07
10041	40	R					Warningsregister b08
10042	41	R					Warningsregister b09
10043	42	R	Regulation Error	Activated	OK	Unit fails to deliver requested output power, May be due to mains fault.	Warningsregister b10
10044	43	R					Warningsregister b11
10045	44	R					Warningsregister b12
10046	45	R					Warningsregister b13
10047	46	R					Warningsregister b14

10048	47	R					Warningsregister b15
10049	48	R	Overtemp	Activated	OK	Internal temperatures too high. Unit has shut down. Check cooling	Alarmsregister b00
10050	49	R					Alarmsregister b01
10051	50	R	Module failiure	Activated	OK	Critical error on one or more power modules. May need service.	Alarmsregister b02
10052	51	R	Alarm Ext A	Activated	OK	Alarm Ext A	Alarmsregister b03
10053	52	R	Alarm Ext B	Activated	OK	Alarm Ext B	Alarmsregister b04
10054	53	R	Polarity control	Activated	OK	Polarity control Fault in CFG of pole reverse	Alarmsregister b05
10055	54	R	External alarm 1	Activated	OK	External alarm 1	Alarmsregister b06
10056	55	R					Alarmsregister b07
10057	56	R					Alarmsregister b08
10058	57	R					Alarmsregister b09
10059	58	R					Alarmsregister b10
10060	59	R					Alarmsregister b11
10061	60	R					Alarmsregister b12
10062	61	R					Alarmsregister b13
10063	62	R					Alarmsregister b14
10064	63	R					Alarmsregister b15

Output Mode: Series or parallel								
PLC	**PLC**	**PC**						
Reg.No	**Discr.**	**Reg .No**	**R/W**	**Name**	**Type**	**Multiplier**	**Description**	**Range**
30001		0	R	Reserved	Unsigned 16bit		Must be zero.	0
30002	10017-10032	1	R	StatusRegister	Unsigned 16bit		Bit register, Indicates status of unit.	0 - 65535
30003	10033-10048	2	R	WarningsRegister	Unsigned 16bit		Bit register, Indicates	0 - 65535
30004	10049-10064	3	R	AlarmsRegister	Unsigned 16bit		Bit register, Indicates	0 - 65535
30005		4	R	Output Voltage	Signed 16bit	*0,01V	Output Voltage	-30000 -
30006		5	R	Output Current	Signed 16bit	*1A/*0.1A	Output Current	-30000 – 30000
30007		6	R	Process Time High Word	Unsigned 16bit	*65536 s	Number of seconds elapsed since Reset of Process Timer.	0 - 999999
30008		7	R	Process Time Low Word	Unsigned 16bit	*1 s	Number of seconds elapsed since Reset of Process Timer. Low Word	

30009		8	R	Ah High Word	Unsigned 16bit	*65536 Ah	Number of Ah since Reset of Ah-Counter. High	0 - 999999
30010		9	R	Ah Low Word	Unsigned 16bit	*1Ah	Number of Ah since Reset of Ah-Counter. Low Word	
30011		10	R					
30012		11	R					
30013		12	R					
30014		13	R					
30015		14	R					
30016		15	R					

7.10.4 Programming example

The unit is controlled from a Profibus master (PC or PLC), parallel duty.
Control the unit as follows:

1. Start the unit by writing 3 to register 40002
2. Set the voltage by writing to register 40003
3. Set the current by writing to register 40004

Operation is supervised by reading registers 30002, 30005 and 30006.

7.10.5 Troubleshooting MODBUS communication

If communication cannot be established:

- Check the communication settings, Baud rate, number of bits, parity, stop bit
- Check that the unit is in Remote mode (yellow LED on front panel).
- Check that the unit has the correct address.
- Check that the cable is correctly terminated. (terminated at the last device in the loop)
- Try reversing the polarity of the fieldbus cable.
- Check that there are not two devices with the same address on the field bus.
- Check that the remote control inputs are configured correctly.

The unit sends low byte first (default). High byte can be sent first if required, by activating the BYTESWAP function.

8 SERVICE & MAINTENANCE

WARNING! Always isolate the unit from the AC supply before working on it.

8.1 PREVENTIVE MTCE

WARNING! Maintenance work on the unit must only be carried out by authorized personnel.
The maintenance intervals depend on the amount of fouling, moisture, etc. the unit is exposed to. The following maintenance must be performed annually:

- Clean heat sink with compressed air
- Check fans for correct operation and any undue noise. Replace if necessary.
- Check/cleaning of the contact surfaces of the output bus bars.
- Check that bolts are tight
- Clean any filters (if any)

8.2 TROUBLE SHOOTING

WARNING! Troubleshooting must only be carried out by authorized personnel.

WARNING! AC Mains voltage is present behind the control PCB of the power module

WARNING! If the front is dismantled and the power module front is exposed, take care not to come close to the blades of the fan. Watch your fingers.

If a fault has occurred in the unit , it can often be traced on the basis of the fault symptoms to a particular main unit, sub-unit or component, which can then be replaced or repaired.

Check which alarm is set
- control module
- power module

The POWER GOOD LED on the power module that has sent the alarm is OFF. The LED does not turn on before the unit has been restarted, even if the reason for the alarm has disappeared and the unit is functioning normally.

Check if the POWER GOOD LED on the power module is lit after restart.

NOTE:

If the mains loses a phase, the unit still works on a low load, with increasing load, the unit sends a regulation error and turns off all LEDs on the power modules.

If the unit is equipped with air filters on the power modules and if the unit is sending a high temperature alarm from the power modules, it can be an indication that the filter needs to be replaced or washed

If the fault cannot be traced to a particular component, the quickest way is usually to divide the unit into main parts and start by checking the main part closest to the supply network, then work through the unit, finishing with the main part closest to the load. For assistance with troubleshooting, contact our service department.

WARNING! Before cables or connectors are disconnected during troubleshooting, the unit must first be isolated from the AC supply.

8.3 REPLACEMENT OF COMPONENTS

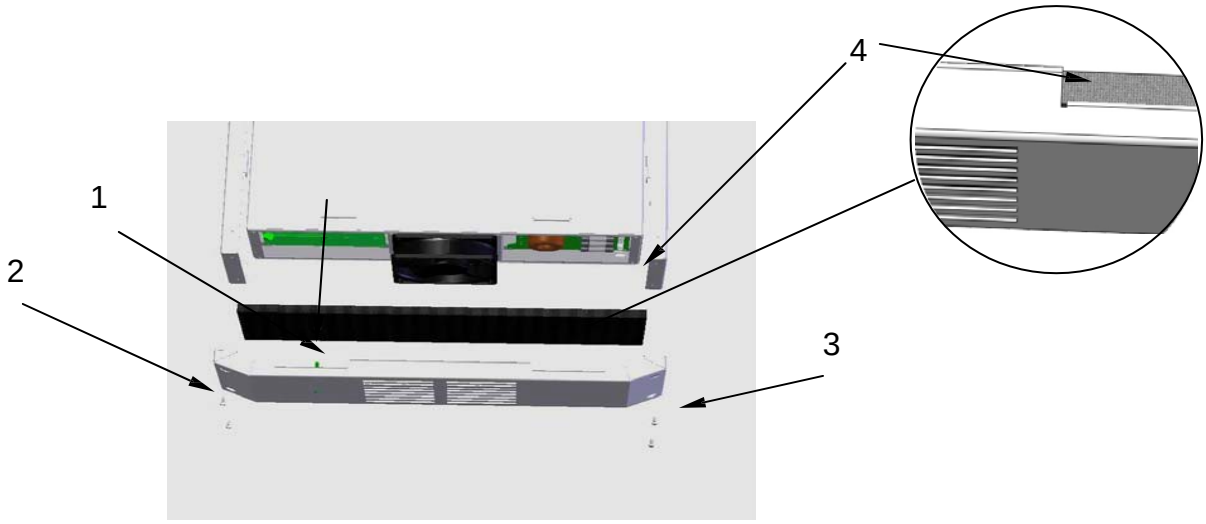
WARNING! Before components are replaced, the unit must be isolated from the AC supply.

The unit does not have primary fuses on the incoming supply.
After changing a component, check that all connections are correct and that the component is securely fixed.

8.3.1 Changing the filter

- Isolate the unit from the AC supply.
- Undo (about one turn) the four screws that hold the front panel, slide the panel to the left and lift off the front panel. Take care not to damage the light guide.
- Remove the old filter. Take care with the light guide.
- Install a new or cleaned filter and install the light guide in the hole.
- Refit the front panel and the light guide to the indicator on the front panel.

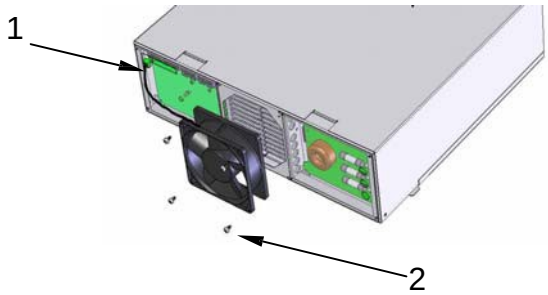
Check that there is nothing in the fan that can prevent rotation, the fan is powerful.



1 Guide, 2 Screws (2), 3 Screws (2), 4 Filter

8.3.2 Replacing the fan in the power module

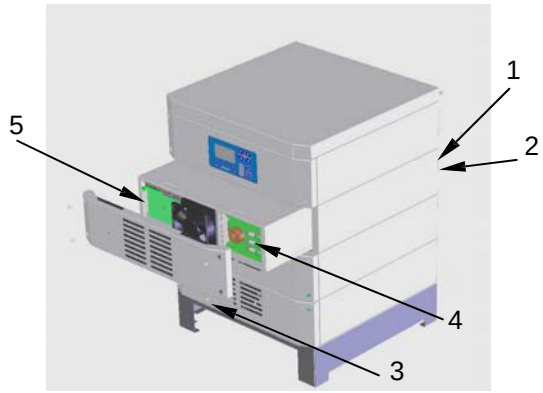
- Isolate the unit from the AC supply.
- Undo (about one turn) the four screws that hold the front panel, slide the panel to the left (10-15mm) and lift off the front panel. Take care not to damage the light guide.
- Disconnect the terminal to the left on the control PCB on the left side inside the power module.
- Unscrew the two screws on the fan.
- Remove the fan & install a new fan.
- Connect the terminal on the PCB
- Add the front panel, add the light conductor for the front plate.
- Check that there is nothing in the fan that can prevent rotation, the fan is powerful.



1 Fan cable terminal
2 Screws, 2 or 4

8.3.3 Replacing the power module

- Isolate the unit from the AC supply.
- Undo (about one turn) the four screws that hold the front panel, slide the panel to the left (10-15mm) and lift off the front panel. Take care not to damage the guide.
- Release the 2-(3) ribbon cables to the left of the power module (5) and disconnect
- Disconnect the ACconnection on the right (three wires).
  NOTE: Pull in the plastic housing **NOT** in the cable. The terminal is equipped with a lock function
- Disconnect the protective earth and the DC connection to the bus bars.
- Unscrew four screws on the back that secure the power module and pull it out.
- Re-install in the reverse order.
  There are two narrow ribbon cables. One is connected to power module 1-5 and the other to power module 6-8. Remember to add the protective earth conductor and the light guide to the indicator on the front of the power module.
- Check that there is nothing in the fan that can prevent rotation, the fan is powerful.

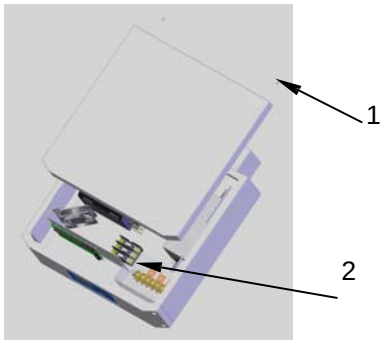


1 Screws in the bus bars
2 Screws in rear panel, 4pc
3 Screws in the front, 4pc
4 Power cable connection
5.Control cables connection

8.3.4 Replacing a fuse in the control unit supply

Remove the cover / expose the control module for access from above.

- Isolate the unit from the AC supply.
- Unscrew the two screws on the rear of the cover.
- Pull the cover backwards (about 15mm) and lift it off.
- Replace the fuses (two or three). They are 10.3x38.1 mm 20A fuses with high breaking capacity, Bussman KLK20 or equal..
- Refit the cover.

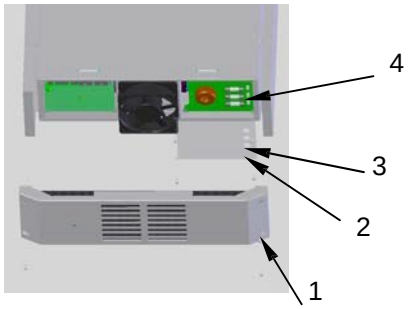


1 Screws in the top, 2pc
2 Fuses

If the control module is fitted in a position other than on top in the rectifier, dismantle the power modules above the control module.

8.3.5 Replacing a fuse in the power module

- Isolate the unit from the AC supply.
- Undo (about one turn) the four screws that hold the front panel, slide the panel to the left (10-15mm) and lift off the front panel. Take care not to damage the light guide.
- Take off the safety guard over the fuses, located on the right-hand side.
- Replace the fuses. They are 10.3x38.1 mm 20A fuses with high breaking capacity, Bussman KLK20 or equal.
- Refit the safety guard.
- Refit the front panel and the light guide to the indicator on the front panel.
- Check that there is nothing in the fan that can prevent rotation, the fan is powerful..



1 Screws in the front, 4pc
2 Screws in the protection, 4pc
3 Safety guard
4 Fuses

9 POWER SUPPLY SPECIFICATION

AC Input voltage:	480 V ± 10%, 3-Phase, 60Hz
EMC conformity - Emission: - Immunity:	 According to IEC / EN 61000-6-4 According to IEC / EN 61000-6-2
LVD conformity:	According to EN 50178
Power factor:	≥ 0.93 @ rated load
Efficiency:	Typical 0.9 @ rated output
Duty Cycle:	100%
Duty rating:	Designed for continuous operation at rated load
DC ripple:	< 1% of rated output current at constant current over the entire regulation range
Voltage & Current regulation range:	0-100% step-less control at constant voltage or current
High speed Voltage & Current regulation accuracy:	±1%
Voltage & Current Stability:	±1%
Over-voltage & Over current protection:	100% of max. output
Operating Temperature:	Max. 40˚C, de-rated output up to 50˚C
Actual run time hour counter:	included
Degree of protection (fan excluded):	IP32
Cooling:	Forced air *or* water cooling
Humidity:	Max. 85% relative, non-condensing

10 PARTS LIST

Part No.	Description	
	Control Module	
A1,8	RFI-Filter	
A2	PCA Control unit	MK 445
A3	PCA LCD display	MK 446
A4	PCA RS 485 converter	MK 436
A5	PCA RS 232 converter	MK 436
A7	Keyboard	
A9	PCA insulated analog I/O	MK 451
A10	PCA analog digital I/O	MK 450
A11	PCA digital I/O	MK 452
A12	PCA Adaption unit	MK 453
A13	PCA Parallel duty	MK 449
E1	Fan	
F1-3	Fuse	
F1-3	Fuse holder	
K1,2	Contactor	
U1	Power supply	
X1	Connection block main supply	
X2,3	Connection terminals 6 pol.	
	Power Module	
292328	Complete power module	
A1:A,B	PCA Primary	MK 470
A2-3:A,B	PCA Snubber	MK 468
A4:A,B	PCA Output	MK 471
A5	PCA fuse unit	MK 469
A5:F1-3	Fuse	
A6	PCA control unit	MK 444
E1	Fan	
L1:A,B	Choke	
T1:A,B	Transformer	
T2:A,B	Current sensor	
V1:A,B	Rectifier	
V2-4:A,B	Diode	
	Led indicator	

Always supply the unit's serial number for a spare part order.

11 MANUFACTURER WARRANTY TERMS & CONDITIONS

1. Unless otherwise specified, the Manufacturer warrants this product at the time of shipment to be of sound design and free from defects in material and workmanship for a **period of two (2) Years** from the date of shipment.

2. To return any products after receipt of the product by the original purchaser, the MAGNAVOLT Customer Service Department must be contacted (info@magnavolt.com), providing the following:
- Serial# of the unit.
- Contact details with department description, telephone and fax number, Email-address
- A detailed description of the error / failure
- Ship to address for the return shipment

2.1 The shipment must be packed properly (preferably in original packaging) to protect the unit against shock, vibration, impact, etc.

2.2 Customer to pay for shipping to MAGNAVOLT and MAGNAVOLT will pay for the return shipment to the customer within the U.S. and Canada.

2.3 Manufacturer will repair free of charge within the terms of this Warranty (paragraph 4).

2.4 Repaired products are warranted for the balance of the original warranty period, or for 30 Days, whichever applies.

3. If inspection by Manufacturer of returned product(s) for warranty repairs does not disclose any defect within the terms of this warranty (paragraph 4), MAGNAVOLT‘s regular repair or replacement charges will apply.

4. Terms of the Warranty:

4.1 Manufacturer nor MAGNAVOLT does not warrant that the product(s) can be used for any particular purpose other than those covered by the applicable product specifications.

4.2 This warranty does not apply to products which were opened by the customer during the Warranty period without Manufacturer’s or MAGNAVOLT‘s express written consent, defects resulting from damages occurred in transit, product modification without the Manufacturer’s or MAGNAVOLT‘s express written consent, improper application of the unit or misuse of the product, assembly or part.

4.3 The Manufacturer nor MAGNAVOLT assumes no liability, in any event, for consequential damages, for anticipated or lost profits, incidental damages or loss of time or any other losses incurred by the purchaser or others in connection with the product(s) covered under this warranty.

5. This warranty specifically excludes and replaces all other expressed or implied warranties.