Operating Manual UCC TEC-380
(NCPA0936G01001)

Commissioning and maintenance may only be carried out by qualified staff!
The operating manual must be read prior to using and/or installing the device and the specifications must be observed! Non-observance may result in the loss of all warranty claims!

Safety Instructions

- **Power supply of protection class I and of protection degree IP20. Do not use outside or in wet or damp rooms.**
- **Valid regulations, in particular VDE 0100 and EN 60204 must be observed!**
- **The permitted ambient temperature range must be observed!**
- **When connecting or disconnecting, the capacitor modules must be discharged.**
- **The capacitor circuit may be under dangerous voltage for a long time after the UCC has been disconnected!**
- **Prior to carrying out work on the capacitor circuit it must be checked whether each individual UC module is discharged.**
- **When carrying out work on the capacitor circuit, the operating manual for the UC modules must implicitly be observed!**

Contents

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1. Brief Description

The UCC (Ultra Capacitor Charger) is a charger for the NessCap Ultracapacitor modules 24F/75V or 36F/75V (UC modules). There are several possiblities to connect the individual modules: From a single module 75V up to five modules with 375V. The device is used in a pitch system of a wind energy plant, where it is exposed to major mechanical stress and temperature fluctuations. As it is part of the wind energy plant's security concept, it is equipped with additional security systems and diagnostics possibilities.

The UCC has the following features:

- Great mechanical stability
- Wide working temperature range
- Particularly immune against electrical interferences
- 2 serial interface ports for connecting a computer (EIA 485) (for data exchange, parameter assignment, service functions, remote monitoring, etc.) and for linking other UCC's
- Integration in PLC possible via RS485 or signalling contacts
- Individual monitoring of the UC modules regarding temperature, polarity reversal and overvoltage
- Capacity measuring and limit monitoring
- Optimum charging of the UC modules with constant current
- Charging stop in case of the UC being overcharged, excess temperature and polarity reversal
- Isolated relay signalling contacts
- Optically isolated open collector signal outputs

2. Standards and Regulations

HF power transformer ensuring a safe isolation of primary/secondary	EN 61558 2-17 (VDE 0570 2-17)
Optocouplers ensuring a safe isolation of various device parts	VDE 0884
EMC safe	EN 61000-6-2:2001 ESD air: 8kV ESD casing: 4kV Burst at 400V AC: 2kV Surge at 400V AC: 2kV/4kV
EMC interference emission	EN 55011 / 1998 /..category A EN 61000-3-2 and EN 61000-3-3 / category A
Environmental testing	EN 60068-2-6 and EN 60068-2-27
Total device	EN 50178 and EN 60950

3. Technical Data

3.1. Electrical data

Rated input voltage	400 V AC 45 – 65 Hz
Input voltage range	340V – 460 V AC 400 V AC -15% / + 15%
Rated input current	1.7 A AC (UE=400V AC)
Max. turn-on current	15A / 0.5msec
Rated output voltage Un	75 … 375 V DC
Charging time for complete charging, max. [1)]	36 F Modules:10 min (25°C) 24 F Modules: 7 min (25°C) 25 min (65°C)
Rated output current	4.5 A DC
Short-circuit current	4.5 A DC
Charging characteristic	Constant current 4.5 A DC When derating 2.5 A DC
Voltage variation during capacity measurement	Un –5.0 / +4.0 V DC

Capacity measurement	1st measurement: When Un is reached 2nd measurement: 30 min. after 1st measurement Further measurements every 24 hours (after a power failure, repetition of this sequence)
Max. power consumption 'worst case'	185 W (Ua = 375 V DC)
Efficiency Ua=225 V DC, Ia= 4.5 A und Ue=400 V AC	Typical 90%
Discharge current (without mains)	<50 mA
Earth leakage current	<3.5 mA
Max. fuse protection	Melting fuse 3 x 4 A T Automatic type C3

[1)] The charging time is the same for all variations (75V, 150V, 225V, 300V, 375V)

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3.2. Indicators

Mains OK	• Green LED, LED is on if supply voltage is within the applicable range
UC Charge	Yellow LED, LED is on while charging as long as the rated output voltage has not yet been reached
UC Charged	Green LED LED is on once the rated voltage has been reached. It goes off again once the minimum output voltage (Ubmin) threshold is reached

Unit Fault	Red LED LED is on if the following is given: • Excess temperature of UC module • UC module capacity below the limit • UC module polarity reversal • UC module overvoltage • Incorrect system configuration

3.3. Operation

Connections COM1, COM2	Connections for control unit with serial EIA 485-Bus.

For this, please also refer to section 8 *Operation via Serial Interface EIA 485*

3.4. Signal input and output

UC OK is given if the UC modules and/or the device are not in error state.
Ready is given if the UC modules and/or the device are not in error state and the UC modules are fully charged.
The UC modules are deemed as charged if Un is reached and the voltage is then higher than Ubmin.

UC OK (Status 1/2)	Transistor exit, short circuit, 24V DC/ 10mA
Ready (Status 3/4)	Transistor exit, short circuit, 24V DC/ 10mA
UC OK (Status 5/6)	Potential-free relay contact, make contact, max. contact rating 50 V DC/ 0.5A
Ready (Status 7/8)	Potential-free relay contact, make contact, max. contact rating 50 V DC/ 0.5A

3.5. General

Weight	Approximately 3.5 kg
Storage temperature	-40...65°C
Cooling	Convection
Comparative humidity	Up to 95%, non-condensing

Operating temperature	-20...65°C
Protection class	IP20 according to IEC 529
Dimensions w x h x d	125x180x255

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4. Installation

The device must be installed in such a way that the required cooling is ensured. A minimum distance of ≥80mm to the neighbouring devices must be observed. It must always be mounted in such a way that sufficient air circulation can be ensured through the device.
All mounting points must always be used for mounting the device. During installation, the device must be covered insofar as drilling chips can fall onto the device or enter it. **(Danger of a short circuit!)**

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5. Connection

Prior to connecting the device, you must check whether the values of the mains voltage and the frequency are in line with the values indicated on the type plate. The connection must be made in line with the designations of the terminals (see schematic circuit diagram and terminal assignment). The connector screws which are not used must be tightened.

Connection:	**Terminal:**
Mains input voltage	Terminal 'Mains' L1, L2 , L3 , ⏚
DC output (UC module)	Terminal 'Ua' +, -
Signalling contact 'UC OK' transistor output	Terminal 'Status' 1.2
Signalling contact 'UC Ready' transistor output	Terminal 'Status' 3.4
Signalling contact 'UC OK' relay contact	Terminal 'Status' 5.6
Signalling contact 'UC Ready' relay contact	Terminal 'Status' 7.8

Serial interface 1 (RS485)	DSUB-9- Pin COM1 A+: Pin 6, A-: Pin 8, GND: Pin 5
Serial interface 2 (RS485)	DSUB-9- Pin COM2 A+: Pin 6, A-: Pin 8, GND: Pin 5
UC module 1 control (monitoring)	See table: Connections UC modules control
UC module 2 control (monitoring)	See table: Connections UC modules control
UC module 3 control (monitoring)	See table: Connections UC modules control
UC module 4 control (monitoring)	See table: Connections UC modules control
UC module 5 control (monitoring)	See table: Connections UC modules control

Connections UC modules control UC1, UC2, UC3, UC4, UC5	**Terminal:**
Digital input VM (voltage monitoring)	1
VCC (5V) supply voltage output for the UC modules	2
GND (0V)	3
NTC temperature sensor "+"	4
NTC temperature sensor "-"	5
Digital input PC (polarity check)	6
Shield	7

Electro mechanics, connections

Connection	**Terminal type**
Type of connection primary 'mains'	Screw terminal 2.5mm^2
Type of connection secondary 'Ua'	Screw terminal 2.5. mm^2
Type of connection control or small signals	Screw terminal 1.5mm^2
Type of connection RS485	DSUB-9 female

In the event of a short circuit or excess load, extremely high currents can flow from the capacitor modules. In order to avoid excess load of the DC output circuit, it must be secured externally!

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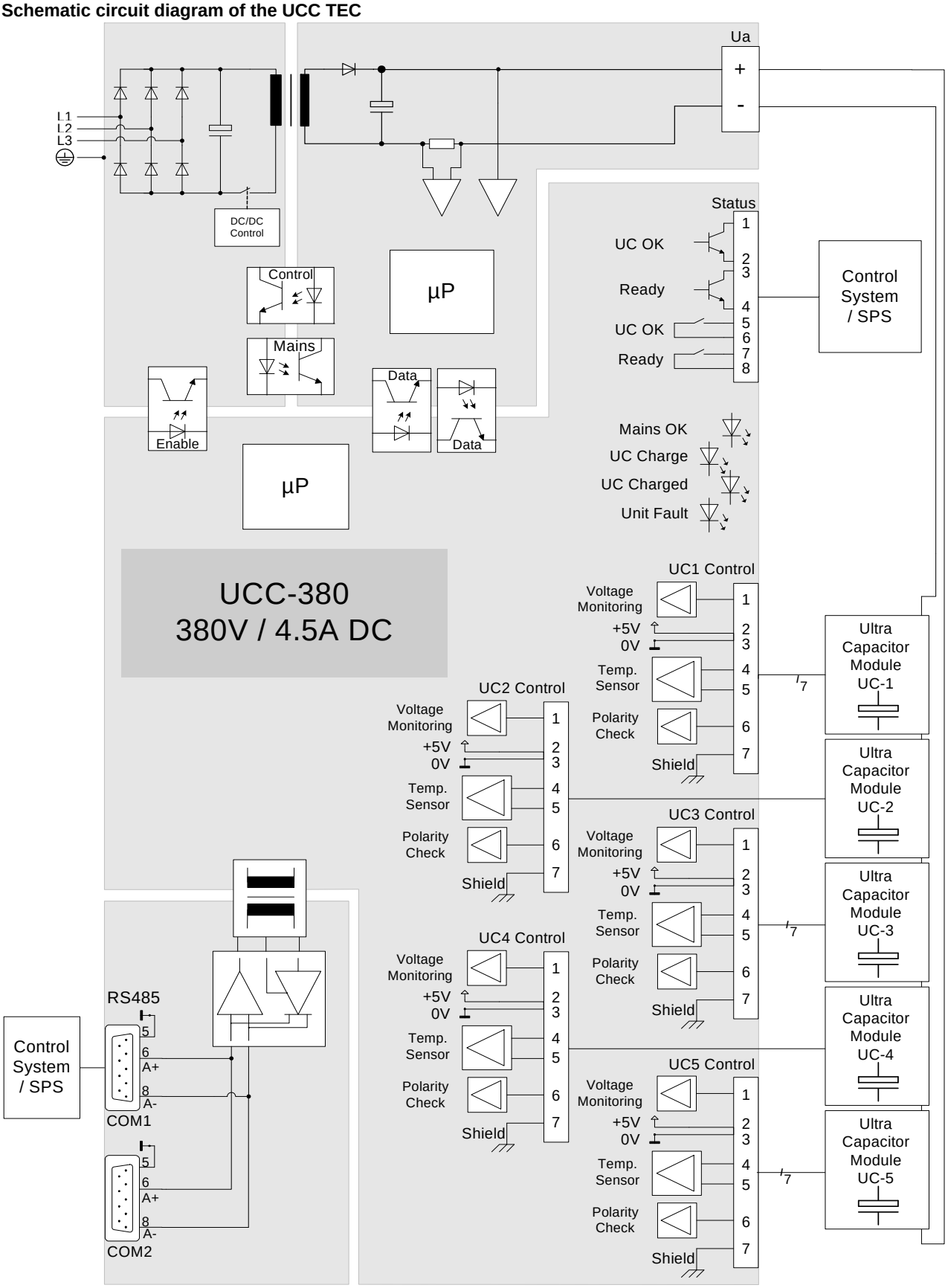
Schematic circuit diagram of the UCC TEC



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6. Startup

The device is switched on through activating the mains. It is not necessary to press the device switch

7. Operation

7.1. Startup

After activating the mains, the device is initialized. The LED 'Mains OK' is on. If there are no faults, the contact 'UC OK' closes and the rated output current flows. The yellow LED 'UC Charge' is on as long as the UC modules are not charged to the rated voltage. As soon as the rated voltage has been reached, the yellow LED goes off and standby operation is indicated by the green LED 'UC Charged' being on. At the same time, the contact 'Ready' closes.

7.2. Buffer operation

If the mains is switched off or the minimum input voltage is undercut, the device goes into buffer operating mode. The LED 'Mains OK' goes off. Now, the capacitor modules discharge either through being used or through self-discharging. If the minimum output voltage Ubmin is undercut, the contact 'Ready' opens and indicates the critical charging situation.

7.3. Fault clearance

Any malfunctions within the UCC and faults of the capacitor modules are indicated through the LED 'Unit Fault' lighting up. The charging of the capacitor modules is stopped.
The contact 'UC OK' or the LED 'Unit Fault' have a collective fault signal function. The individual causes of the faults are described below.
We distinguish between two kinds of faults:

Power-cut faults switch off the output voltage of the UCC charger with a lasting effect and can only be reset through switching the input voltage *OFF* and *ON*.

Automatic reset faults switch off the output voltage of the UCC charger, however they switch on again immediately as soon as the fault does not exist anymore.

Fault type	Fault description	Reaction to the fault	Type of reaction
„Module x reverse polarity fault“ (assessment of individual modules)	Module with reverse polarity	Switching off the output voltage Connecting the *Ua* after switching the power supply off and on	Power down
„Module x voltage fault“ (assessment of individual modules)	Overvoltage signal high if Uc less than limit 1 Overvoltage signal low if Uc more than limit 2	Switching off the output voltage Connecting the *Ua* when clearing the fault	Automatic reset
“Fault module number”	Number of the connected modules is not in line with the set parameters	Switching off the output voltage Connecting the *Ua* after switching the power supply off and on	Power down
„Module x excess temperature“ (assessment of individual modules)	Fault if limiting temperature is exceeded	Switching off the output voltage Connecting the *Ua* if the limiting temperature is undercut	Automatic reset
“Capacity fault”	Minimum capacity is undercut	Switching off the output voltage Connecting the *Ua* after switching the power supply off and on	Power down
Power failure	Supply voltage collapses	Switching off the output voltage Is not signalized via the signal outputs Connecting the *Ua* after re-activating the power supply	Automatic reset

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7.4. Derating in the case of a high ambient temperature

An internal temperature sensor protects the UCC against overheating. This sensor is located next to the component which is most exposed to heat, on a heat sink. Once typ. 95°C have been reached, it reacts. In case of high ambient temperatures, this internal limiting temperature can be exceeded in charging mode. In this case, the UCC limits the charging current until the internal limiting temperature is undercut again. This results in an entire charging cycle lasting longer.

7.5. Capacity measurement

In standby operation, the UC modules' current capacity is determined once per day during ongoing operations. For this purpose, the output voltage is initially reduced by 5V. Then, the UC modules are charged with a constant current until an additional voltage of 9V have been reached. After this, the voltage decreases again to the rated output voltage.
NB: UC modules which have been discharged for several hours will require significantly more time for recharging again for the first time. Thus, a higher (apparent) capacity is determined with the first capacity measurement immediately after the UC modules having been recharged. The second measurement, after about 30 min., provides a value which hardly differs from the following values.

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8. Operation via the Serial Interface EIA 485

The device has two looped serial interfaces compliant to the Standard RS485 and/or EIA-485. They are isolated from all other parts of the device. Use the Windows software paraTEC_UCC to read the UCC's status and parameters.

8.1. Electrical Termination of the EIA 485 interface

The two signal lines of the two-wire bus can be adapted to the overall system using a connectable resistance of 120 Ohms. If the UCC is the last device connected to the two-wire bus EIA 485, then the resistor should be connected too. A DIP switch is located between the COM1 and COM2 ports and can be operated externally (**only actuate the switch in dead mode!).**

DIP switch COM1, COM2	**Switch position** [1]
Without adjustment resistance 120 Ohms	OFF
With adjustment resistance 120 Ohms	ON [2]

[1] Can also be measured with a Ohm meter between pins A+ und A- .In this case, both interfaces must not be connected.
[2] Default setting

8.2. Electrical Connection to a Computer with a Standard Serial Port RS232

You cannot directly connect the EIA-485 port of the UCC to your serial port at the computer. A RS-232 to EIA-485 converter is needed which has the RS-232-signal on one side and the EIA-485 signals on the other side.

Wiring between RS-232 to RS-485 Converter and UCC:
Use this table to make a cable:

EIA-485 - Signals at Converter	**EIA-485 – Signals at UCC**	
	Signal name	**UCC Pin**
Ground	Ground	Pin 5
A+	A+	Pin 6
A-	A-	Pin 8

Wiring between PC and Converter:
Use a standard RS232-cable (crossed signals) to connect it to your computer or make a cable using the following table

RS-232-Signals on PC- Com-Port	**RS-232-Signals at Converter**
Ground	Ground
RxD	TxD
TxD	RxD

8.3. Software Settings of the Serial Interface.

Baud rate: 19200
Data bits: 8
No parity
Stop bits: 1

The software paraTEC_UCC automatically sets the communication settings. This must not be configured.

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8.4. Operation with the paraTEC_UCC software

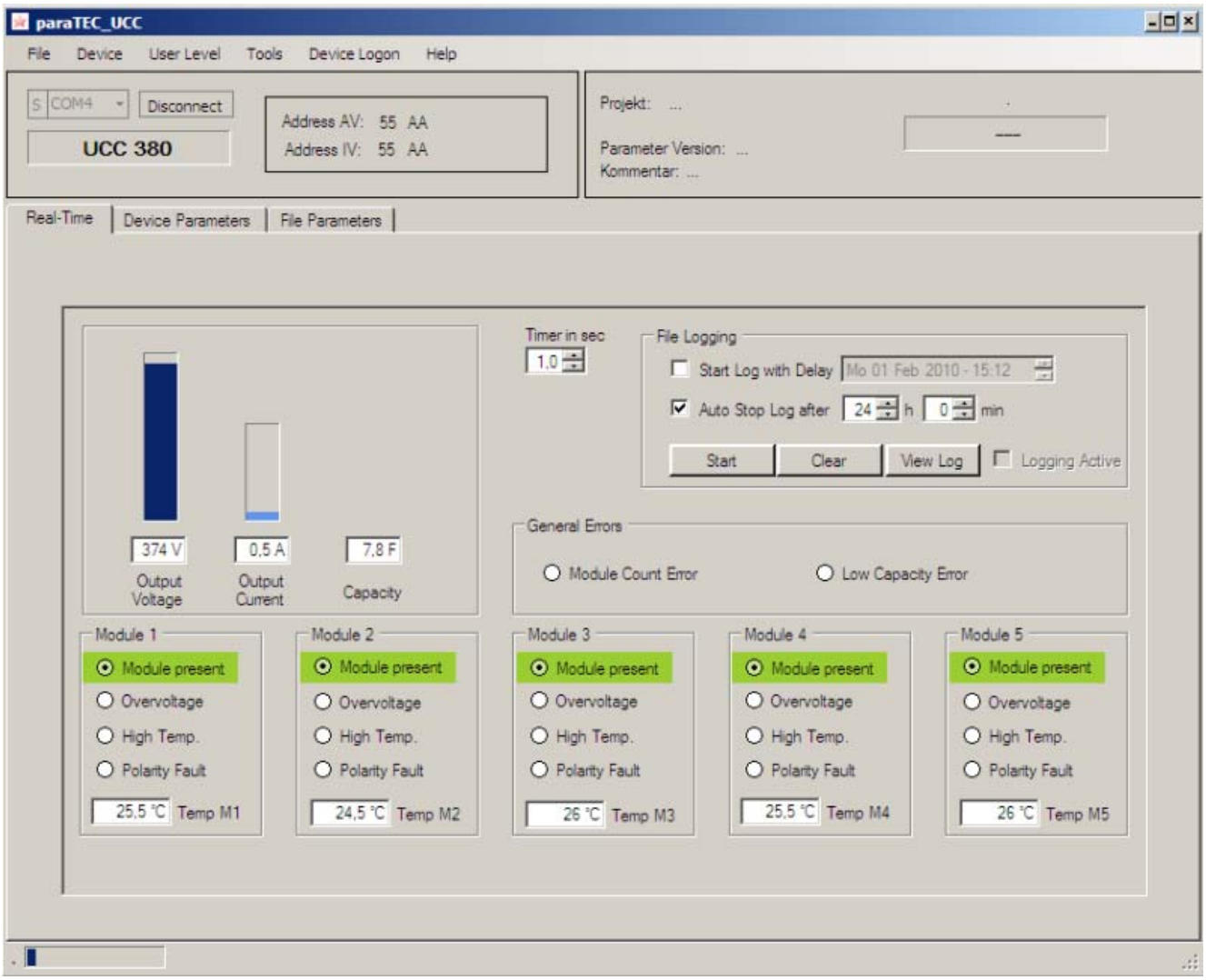

Figure 1: paraTec_UCC connected to an UCC during normal operation.

Initialization of the connection
Select the right COM-Port and press the Connect-button
Now you can switch between three tabs, the ‘Real-Time’, ‘Device Parameters’ an ‘File Parameters’ tab

9. Decommmissioning

Decommissioning is carried out by disconnecting the power supply.
In case of connected UC modules, the device is supplied via the output lines and the internal controller continues running until the voltage Ua has declined to below 10V.

Never disconnect electrical connections during operation or if the UC modules are charged!
You may also not create any current linkages during operations or in the case of charged UC modules!
For carrying out work on the capacitor circuit, the UCC must be placed out of operation and the capacitors must be discharged under control via a discharge resistance to 0V.
The state of charge of the UC modules must be individually determined module by module.

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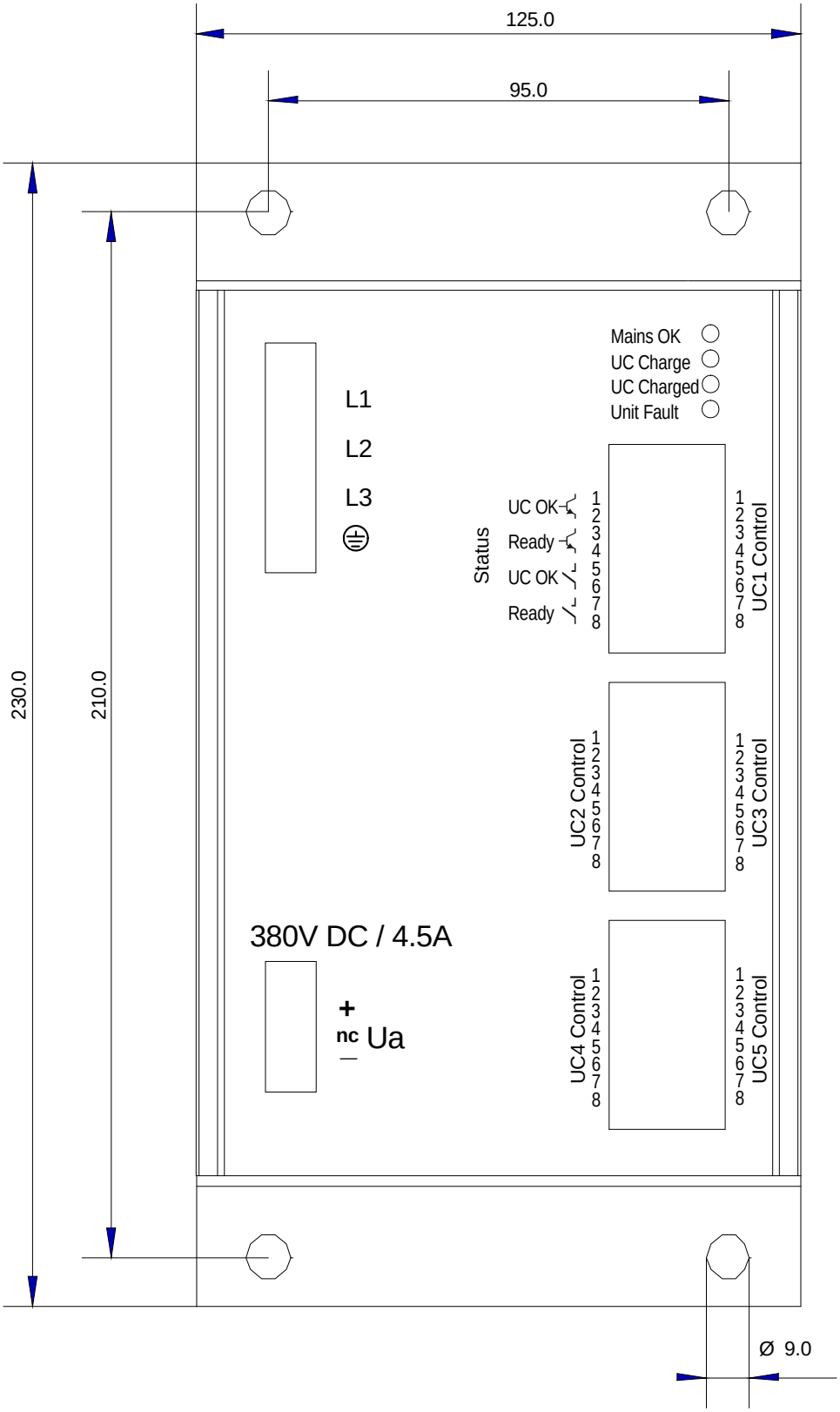
10. Installation Diagram



View of the front (top view)
Figure similar

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