LAB-HP

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INFO & CONTACT ADDRESSES

ET System electronic GmbH was founded in 1986 in the heart of the Rhine-Neckar-Triangle. As a subsidiary of a leading electricity utility group, the company quickly took on a leading role in the area of laboratory power electronics and associated electrical measurement. The existing know-how in power technologies in the 90s gave rise to the "Power Solutions" product division as a strong extension of the historical "Test & Measurement" range.

Since 1997, we have been working successfully as an independent, privately held company with customers in all lines of business from industry, medical care, railway technology and automotive electronics.

By means of our high vertical range of manufacture and our ever-expanding development division, we can fast and flexibly adjust to our customers' requirements. Necessary approvals such as CSA, UL, VDE, TÜV etc. are flexibly carried out by qualified personnel. The approval procedures are performed within the scope of development planning and thus do not negatively impact the start of manufacturing. Permanent manufacturing control through accredited laboratories and an ISO 9001 compliant quality management system guarantee a constant high-level series-production quality.

We offer repairs and adjustments for units outside of our warranty period. Please contact your local distributor for further information:

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Register Number:	HRB 421186

TECHNICAL SPECIFICATIONS

INPUT DATA 3 KW – 15 KW

EINGANGSDATEN 3KW - 15 KW
INPUT DATA 3KW - 15 KW

Höhe	*Height*	2HE / U				3HE / U	
Ausgangsleistung	*Output power*	3kW	4kW	5kW	7kW	10kW	15kW
Netzanschluss Information	***Grid connection-information***						
Netzanschluss	*Grid connection*	3 wire (P+N+PE) / 4 wire (3P+PE) / 5 wire (3P+N+PE)					
Eingang 1P/230	*Input 1P/230*	1 x 230 VAC (207-253 VAC 47-63Hz)					
Eingang 3P/200	*Input 3P/200*	3 x 200 VAC (180-220 VAC 47-63Hz)					
Eingang 3P/208	*Input 3P/208*	3 x 208 VAC (187-229 VAC 47-63Hz)					
Eingang 3P/400	*Input 3P/400*	3 x 400 VAC (360-440 VAC 47-63Hz)					
Eingang 3P/440	*Input 3P/440*	3 x 440 VAC (396-484 VAC 47-63Hz)					
Eingang 3P/480	*Input 3P/480*	3 x 480 VAC (432-528 VAC 47-63Hz)					
Eingangsstrom 1P/230 V /[Arms] [1]	*Input current 1P/230 V /[Arms] [1]*	22	28	33	x [2]	x [2]	x [2]
Eingangsstrom 3P/200 V /[Arms] [1]	*Input current 3P/200 V /[Arms] [1]*	13.9	18.5	23.2	32.5	46.3	69.4
Eingangsstrom 3P/208 V /[Arms] [1]	*Input current 3P/208 V /[Arms] [1]*	13.4	17.8	22.3	31.2	44.5	66.7
Eingangsstrom 3P/400 V /[Arms] [1]	*Input current 3P/400 V /[Arms] [1]*	7	9.3	11.6	16.6	23.2	34.7
Eingangsstrom 3P/440 V /[Arms] [1]	*Input current 3P/440 V /[Arms] [1]*	6.4	8.5	10.6	14.8	21.1	31.6
Eingangsstrom 3P/480 V /[Arms] [1]	*Input current 3P/480 V /[Arms] [1]*	5.8	7.8	9.7	13.6	19.3	28.9
Netzinformationen	***Grid characteristics***						
Einschaltstrom [3]	*Transient inrush current [3]*	< 25				< 51	
Maximale erlaubte Netzasymetrie (3P-System)	*Max. allowed asymmetry (3P-System)*	<3%					
Ableitstrom	*Leakage current*	< 35 mA					
Lesitungsfaktor	*Power factor*	> 0.7					
Oberwellengehalt [3]	*Harmonic content [3]*	50Hz = 72% | 100Hz = 2% | 150Hz = 0.9% | 200Hz = 0.1% | 250Hz = 11% | 350 Hz = 0.6%					
Effizienz (typisch)	*Efficiency (typical)*	94%					
Sicherungs Informationen	***Circuit breaker information***						
Empfohlener Sicherungsautomat 3P/400 model (Wert und Kurve)	*Recommended circuit breaker 3P/400 model (value and curve)*	16 A Type D/K	16 A Type D/K	16 A Type D/K	32 A Type D/K	32 A Type D/K	63 A Type D/K

[1] gilt für Nenneingangsspannung
[2] ist nicht standard oder nicht verfügbar
[3] gilt für Nenneingangsspannung; der Einschaltstrom tritt nur beim ersten Anlegen der Eingangsspannung auf

[1] *for nominal current and nominal voltage*
[2] *not standard or not available*
[3] *for nominal input voltage; the inrush current occurs only when first connecting to the grid*

INPUT DATA 18 KW – 63 KW

EINGANGSDATEN 18 KW - 63 KW
INPUT DATA 18 KW - 63 KW

Höhe	*Hight*	3HE / U	6HE / U			9HE / U		
Ausgangsleistung	*Output power*	21kW	30kW	35kW	45kW	49kW	56kW	63kW

Netzanschluss Information	***Grid connection information***							
Netzanschluss	*Grid connection*	3 wire (P+N+PE) / 4 wire (3P+PE) / 5 wire (P+N+PE)						
Eingang 1P/230	*Input 1P/230*	1 x 230 VAC (207-253 VAC 47-63Hz)						
Eingang 3P/200	*Input 3P/200*	3 x 200 VAC (180-220 VAC 47-63Hz)						
Eingang 3P/208	*Input 3P/208*	3 x 208 VAC (187-229 VAC 47-63Hz)						
Eingang 3P/400	*Input 3P/400*	3 x 400 VAC (360-440 VAC 47-63Hz)						
Eingang 3P/440	*Input 3P/440*	3 x 440 VAC (396-484 VAC 47-63Hz)						
Eingang 3P/480	*Input 3P/480*	3 x 480 VAC (432-528 VAC 47-63Hz)						
Eingangsstrom 1P/230 Modell /[Arms] [1]	*Input current 1P/230 model /[Arms] [1]*	x [2]	x [2]	x [2]	x [2]	x [2]	x [2]	x [2]
Eingangsstrom 3P/200 Modell /[Arms] [1]	*Input current 3P/200 model /[Arms] [1]*	97.1	138.7	161.8	208	226.5	258.9	291.2
Eingangsstrom 3P/208 Modell /[Arms] [1]	*Input current 3P/208 model /[Arms] [1]*	93.4	133.4	155.6	200	217.8	248.9	280
Eingangsstrom 3P/400 Modell /[Arms] [1]	*Input current 3P/400 model /[Arms] [1]*	48.6	69.4	80.9	104	113.3	129.5	145.6
Eingangsstrom 3P/440 Modell /[Arms] [1]	*Input current 3P/440 model /[Arms] [1]*	44.2	63.1	73.6	94.6	103	117.7	132.4
Eingangsstrom 3P/480 Modell /[Arms] [1]	*Input current 3P/480 model /[Arms] [1]*	40.5	57,8	67.4	86,7	94.4	107.9	121.4

Netzinformationen	***Grid characteristics***							
Einschaltstrom [3]	*Inrush Transient current [3]*	< 76	< 102	< 127	< 153	< 178	< 203	< 229
Maximale erlaubte Netzasymetrie (3P-System)	*Max.allowed asymmetry (3P-System)*	<3%						
Ableitstrom	*Leakage current*	< 35 mA						
Leistungsfaktor	*Power factor*	> 0.7						
Oberwellengehalt [3]	*Harmonic content [3]*	50Hz = 72% | 100Hz = 2% | 150Hz = 0.9% | 200Hz = 0.1% | 250Hz = 11% | 350 Hz = 0.6%						
Effizienz (typisch)	*Efficiency Type*	94%						

Sicherungs-Informationen	***Circuit breaker information***							
Empfohlener Sicherungsautomat 3P/400 model (Wert und Kurve)	*Recommended circuit breaker 3P/400 model (value and curve)*	63 A Type D/K	80 A Type D/K	120 A Type D/K	120 A Type D/K	150 A Type D/K	150 A Type D/K	180 A Type D/K

[1] gilt für Nenneingangsspannung
[2] ist nicht standard oder nicht verfügbar
[3] gilt für Nenneingangsspannung; der Einschaltstrom tritt nur beim ersten anlegen der Eingangsspannung auf

[1] *applies to rated input voltage*
[2] *not standard or not available*
[3] *applies to rated input voltage; the inrush current occurs only when first connecting to the grid*

OUTPUT DATA

AUSGANGSDATEN
OUTPUT DATA

Ausgangsrest-welligkeit	***Output ripple***										
Spannungsbereich in [V] für Spezif. unten	*Voltage range in [V] for spec. below*	0-15	16-35	36-70	71-120	121-350	351-700	701-900	901-1150	1151-1400	1401-1500
Restwelligkeit Spannung (mVpp) 20MHz	*Voltage ripple (mVpp) 20MHz*	40	80	140	140	900	350	350	400	850	900
Restwelligkeit Spannung (mVpp) 300kHz	*Voltage ripple (mVpp) 300kHz*	15	35	60	60	400	250	250	300	500	550
Restwelligkeit Spannung (mVrms) 20MHz	*Voltage ripple (mVrms) 20MHz*	15	35	60	60	400	150	150	150	150	200
Restwelligkeit Spannung (mVrms) 20MHz	*Voltage ripple (mVrms) 300kHz*	10	25	40	40	300	100	100	100	100	150
Restwelligkeit Strom (App)	*Current ripple (App)*	< 0.5% of F.S. of Imax from one 7KW-Unit									
Restwelligkeit Strom (mArms)	*Current ripple (mArms)*	600	380	260	220	60	30	25	15	12	12

Ausgangs-geschwindigkeit	***Output speed***										
Spannungsbereich in [V] für Spezif. unten	*Voltage range in [V] for spec. below*	0-15	16-35	36-70	71-120	121-350	351-700	701-900	901-1150	1151-1400	1401-1500
Anstiegszeit, Volllast	*Rise tme, full load*	6ms	6ms	12ms	20ms	20ms	20ms	40ms	40ms	40ms	6ms
Anstiegszeit, Leerlauf	*Rise time, no load*	5ms	5ms	10ms	10ms	10ms	10ms	10ms	20ms	20ms	5ms
Abfallzeit, Volllast	*Fall time, full load*	15ms	15ms	20ms	20ms	40ms	50ms	60ms	80ms	100ms	25ms
Abfallzeit, Leerlauf	*Fall time, no load*	tf < 5s @ Ua < 60V				10s				15s	1s
Ausregelzeit bei Dynamischer Laständerung	*Dynamic response time during load variations*	< 3ms									

Isolation	***Insulation***		
Spannungsbereich in [V] für Spezif. unten	*Voltage range in [V] for spec. below*	0-300V	301V -1500V
Primär / Sekundär	*Primary / secondary*	3000 VAC	
Primär / PE	*Primary / earth*	2150 VDC	
DC-Ausgang / PE	*DC output / earth*	500 VDC	2000 VDC

Ausgangsstablilität	***Output stability***
Statische Ausregelung	*Static regulation*	±0.1% F.S.
Spannungsstabilität bei Netzänderung	*Voltage stability during line variation*	±0.02% F.S.
Stromstabilität bei Netzänderung	*Current stability during line variation*	±0.02% F.S.
Spannungsstabilität bei Laständerung	*Voltage stability during load variation*	±0.05% F.S. ± 20mV
Stromstabilität bei Laständerung	*Current stability during load variation*	±0.05% F.S. ± 20mA

Genauigkeit-Setzwert	***Accuracy of SET-Value***
Spannung	*Voltage*	0.1%
Strom	*Current*	0.2%
Spannung bei Sensebetrieb	*Voltage during sense operation*	0.50%
Spannung bei M/S-Serien-Betrieb	*Voltage during M/S-serial operation*	0.1% x N (N :Anzahl der Geräte/ number of devices)
Strom bei M/S-Parallel-Betrieb	*Current during M/S-parallel operation*	0.2% x N (N: Anzahl der Geräte/ number of devices)

Auflösung des Anzeigewertes	***Resolution of displayed value***				
Spannungsbereich in [V] für Spezif. Unten	*Voltage range in [V] for spec. below*	20V - 99.99V		100.0V - 999.9V	1000V - 1500V
Spannung	*Voltage*	00.00		000.0	0000
Spannung bei M/S-Serien-Betrieb	*Voltage during M/S-serial operation*	N x 00.01		N x 000.1	N x 0001
Strombereich in [A] für Spezif. Unten	*Current range in [A] for spec. below*	0.000A - 9.999A	10.00A - 99.99A	100.0A - 999.9A	1000A - 99999A
Strom	*Current*	0.000	00.00	000.0	00000
Strom bei M/S-Parallel-Betrieb	*Current during M/S-parallel operation*	N x 0.001	N x 00.01	N x 000.1	N x 00001

DEVICE FUNCTION

GERÄTEFUNKTION
DEVICE FUNCTION

Gerätefunktionen	*Device function*		
OVP		Überspannungsschutz: Zwischen 0% und 120% des Spannungsbereichs einstellbar	*Over Voltage Protection: is adjustable between 0% and 120% of maximum voltage*
OCP		Überstromschutz: Wird durch den Stromsollwert realisiert. Der Ausgangsstrom kann nicht höher als der eingestellte Strom sein	*Over Current Protection: is realised by the current setpoint. The output current can not go over the set output current*
OTP		Übertemperaturschutz: Wenn die interne Temperatur am Kühlkörper über 90°C ist, wird das Gerät automatisch abgeschaltet	*Over Temperature Protection: If the internal heat sink temperature is above 90°C the device will automatically shut down*
UVLO		Unterspannungssperre: Bei Unterschreiten des eingestellten Werts schaltet das Gerät ab.	*Under Voltage Lockout: The device shuts down the voltage falls below this value*
UI-MODE		Betriebsart: Spannungs- und Strombegrenzung des Ausgangs	*Operating mode: Voltage- and current-limited output*
UIP-MODE		Betriebsart: UI-MODE mit zusätzlicher Leistungsbegrenzung. Nur für LAB/HP	*Operating mode: UI-MODE with additional power limit. Only for LAB/HP*
UIR-MODE		Betriebsart: UI-MODE mit einstellbarem Innenwiderstand	*Operating mode: UI-MODE with adjustable internal resistance*
PV-SIM-MODE		Simulation einer Photovoltaik-Zelle. Nur für LAB/HP	*Simulation of a photovoltaics-cell. Only for LAB/HP*
SLOPE-FUNCTION		Einstellbare Anstiegszeit für Strom und Spannung. Bereich Minimum 1 A/S bzw. 1 V/S Bereich Maximum 30 ms bis V_{max} bzw. I_{max}. Nur für LAB/HP	*Adjustable rise time for current and voltage. Range-minimum 1A/s resp. 1V/s | range-maximum is 30ms to V_{max} resp. I_{max} . Only for LAB/HP*
AI-FILTER		Einstellbarer Gleitender-Mittelwert-Filter für Sollwerte die über die Analog-Schnittstelle übertragen werden. Das Intervall über das gemittelt wird ist zwischen 0s und 80s konfigurierbar.	*Adjustable moving average filter for set-values that are transmitted over the analog interface. The interval over which the average is calculated can be configured between 0s and 80s.*
t-ENABLE		Einstellbare Einschaltdauer nach Drücken der Starttaste (Standby). Die Dauer lässt sich zwischen 1s und ca. 18h einstellen. Nur für LAB/HP	*Adjustable operating time after pressing the start button (Standby).The operating time is configurable between 1s and ca. 18h. Only for LAB/HP*

INTERFACES

SCHNITTSTELLEN
INTERFACES

Analogschnittstelle	**Analog interface**		
Digital Ausgang (CV, Standby,Error)	*Digital outputs (CV, Standby,Error)*	Ausgabeart: Offener Kollektor mit Pull-up-Widerstand 10kΩ nach +5V Isinkmax: 50mA	*Output type: Open collector with pull-up resistor 10kΩ after +5V Isinkmax: 50mA*
Digital Eingang (Ext. Control, standby)	*Digital inputs (Ext. control, standby)*	Eingangswiderstand: 47kΩ Maximale Eingangsspannung: 50V High-Pegel: Uin > 2V Low-Pegel: Uin < 0.8V	*Input resistance: 47kΩ* *Maximum input voltage: 50V* *High level: Uin > 2V* *Low level: Uin < 0.8V*
Analog Ausgang (Xmon)	*Analog output (Xmon)*	Ausgangswiderstand: 100Ω Minimal zulässiger Lastwiderstand: 2kΩ Minimaler Lastwiderstand für ± 0.1% Genauigkeit: 100kΩ	*Output resistance : 100Ω* *Minimum permissible load resistance : 2kΩ* *Minimum load resistance for ± 0.1% accuracy: 100kΩ*
Analog Eingang (Xset)	*Analog input (Xset)*	Eingangswiderstand: 1MΩ maximal zulässige Eingangsspannung 25 V Formatierung	*Input resistance: 1MΩ* *Maximum permissible input voltage: 25V*
Referenz Spannung	*Reference voltage*	Referenzspannung Uref: 10V ± 10mV Ausgangswiderstand: < 10Ω Maximaler Ausgangsstrom: 10mA (nicht kurzschlussfest	*Reference voltage Uref: 10V ± 10mV* *Output resistance: < 10Ω* *Maximum output current: 10mA (not short-circuit-proof)*
5V - Spannung	*5V - supply voltage*	Ausgangsspannung 5V ± 300mV: Maximaler Ausgangsstrom 50mA (nicht kurzschlussfest)	*Output voltage: 5V ± 300 mV* *Maximum output current: 50mA (not short-circuit-proof)*
Setzwertgenauigkeit bei Verwendung der internen Referenz	*Set-Value accuracy (V/A) when using internal reference*	± 0.5%	± 0.5%
Verzugszeit	*Response time*	< 10ms	< 10ms

RS232			
Signal-Eingang (RxD,CTS)	*Signal inputs (RxD,CTS)*	Maximale Eingangsspannung: ± 25V Eingangswiderstand: 5kΩ (Type) Umschalten der Wellwerte: UH < -3V , UL > +3V	*Maximum input voltage: ± 25V* *Input resistance: 5kΩ (Type)* *Switching thresholds: UH < -3V , UL > +3V*
Signal-Ausgang (TxD,RTS)	*Signal outputs (TxD,RTS)*	Ausgangsspannung (bei RL > 3kΩ): min ± 5V, Typ ± 9V, max ± 10V Ausgangswiderstand: < 300Ω Kurzschlussstrom: Type ± 10mA	*Output voltage (at RL > 3kΩ):* *min ± 5V, Type ± 9V, max ± 10V* *Output resistance: < 300Ω* *Short circuit current: Type ± 10mA*

RS485			
Maximale Eingangs-spannung	*Maximum input voltage*	± 5V	*± 5V*
Eingangswiderstand	*Input resistance*	> 12 kΩ	*> 12 kΩ*
Ausgangsstrom	*Output current*	± 60 mA Max	*± 60 mA Max*
High-Pegel	*High level*	Ud > 0.2V	*Ud > 0.2V*
Low-Pegel	*Low level*	Ud < -0.2V	*Ud < -0.2V*

Master / Slave			
Anzahl der Geräte	*Number of devices*	bis zu 8	*up to 8*
Maximale Spannung Reihenschaltung	*Maximum voltage in series*	1000V	*1000V*
Maximale Leistung Standard Gerät	*Maximum power standard device*	LAB/HP 504 kW	*LAB/HP 504 kW*
Maximale Leistung Sonderversionen	*Maximum power custom device*	1.4 MW	*1.4 MW*

STANDARD SPECIFICATIONS

STADNDARD-ANGABEN
STANDARD SPECIFICATIONS

Sicherheits-Norm	*Safety standard*	EN 61010-1: 2010	*EN 61010-1: 2010*
EMV	*EMC*	EN 61326-1: 2013	*EN 61326-1: 2013*
RoHS	RoHS	EN 50581: 2012	*EN 50581: 2012*

Umgebungs-bedingungen	***Ambient conditions***		
Kühlmethode	*Cooling method*	Lüfter	*Fans*
Betriebstemperatur	*Operating temperature*	0 - 50°C	*0 - 50°C*
Lagertemperatur	*Storage temperature*	-20°C - 70°C	*-20°C - 70°C*
Luftfeuchtigkeit	*Humidity*	< 80 %	*< 80 %*
Betriebshöhe	*Operating height*	< 2000 m	*< 2000 m*
Vibration	*Vibration*	10-55Hz / 1 min / 2G XYZ	*10-55Hz / 1 min / 2G XYZ*
Schock	*Shock*	< 20G	*< 20G*
Schutzart	*Protection class*	IP 20	*IP 20*
Überspannungskategorie	*Over voltage category*	II	*II*
Verschmutzungsgrad	*Pollution degree*	II	*II*

Gewicht/Abm.	***Weight/Dimensions***		
LAB/HP 3-7 kW	*LAB/HP 3-7 kW*	14 kg / 19" x 2 HE x 440mm	*14 kg / 19" x 2 U x 440mm*
LAB/HP 10 kW	*LAB/HP 10 kW*	26 kg / 19" x 3 HE x 620mm	*26 kg / 19" x 3 U x 620mm*
LAB/HP 15 kW	*LAB/HP 15 kW*	26 kg / 19" x 3 HE x 620mm	*26 kg / 19" x 3 U x 620mm*
LAB/HP 21 kW	*LAB/HP 21 kW*	37 kg / 19" x 3 HE x 620mm	*37 kg / 19" x 3 U x 620mm*
LAB/HP 30 kW	*LAB/HP 30 kW*	52 kg / 19" x 6 HE x 620mm	*52 kg / 19" x 6 U x 620mm*
LAB/HP 35 kW	*LAB/HP 35 kW*	59 kg / 19" x 6 HE x 620mm	*59 kg / 19" x 6 U x 620mm*
LAB/HP 45 kW	*LAB/HP 45 kW*	73 kg / 19" x 6 HE x 620mm	*73 kg / 19" x 6 U x 620mm*
LAB/HP 49 kW	*LAB/HP 49 kW*	85 kg / 19" x 9 HE x 620mm	*85 kg / 19" x 9 U x 620mm*
LAB/HP 56 kW	*LAB/HP 56 kW*	92 kg / 19" x 9 HE x 620mm	*92 kg / 19" x 9 U x 620mm*
LAB/HP 63 kW	*LAB/HP 63 kW*	99 kg / 19" x 9 HE x 620mm	*99 kg / 19" x 9 U x 620mm*

DEVICE FEATURES

GERÄTEMERKMALE ***DEVICE FEATURES***

Gerätetyp / **Funktion**	***Device type*** / ***Function***	**LAB/HP**	**LAB/HP/E**	**LAB/HP /C**	**LAB/HP/E /CE**
TFT-Touch-Display [2]	*TFT touch display [2]*	-	-	x	-
TFT-Display [2]	*TFT display [2]*	-	-	-	x
7-Segment-Display	*7 Segment display*	-	x	-	-
Grafisches Display	*Graphic display*	x	-	-	-
USB-Port	*USB port*	-	-	x	-
Master/Slave Funktion	*Master/slave function*	x	-	x	-
Soft-Interlock	*Soft interlock*	x	-	x	-
UI-Modus	*UI mode*	x	x	x	x
UIP-Modus	*UIP mode*	x	-	x	-
UIR-Modus	*UIR mode*	x	-	x	-
Simulation von PV-Kennlinien	*Simulation of PV arrays*	x	-	x	-
SD Kartenleser	SD-Slot	x	-	-	-

OPTIONS LIST

OPTIONSLISTE *OPTIONS LIST*

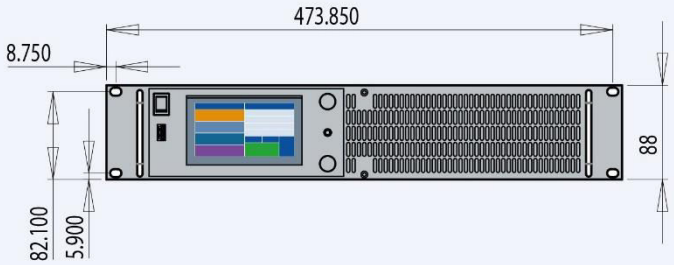
Option	Option für	*Option for*	LAB/HP	LAB/HP/E
DC	DC-Eingang wählbar zwischen 250 - 750 VDC	*DC Input selectable between 250 - 750 VDC*	x	x
ATE	ATE ohne manuelle Bedienung	*ATE without manual control*	x	x
IEEE 448	IEEE 488 Schnittstelle	*IEEE 488 interface*	x	x
RS 485	RS 485 Schnittstelle	*RS 485 interface*	x	x
USB	USB Schnittstelle	*USB interface*	x	x
2000 V	2000 VDC Ausgangsspannung (Applikation muss bekannt sein, kontaktieren Sie uns)	*2000 VDC output voltage (Application must be considered, contact us)*	x	x
HS	Highspeed, sekundärseitige Anstiegs- und Abfallzeit um Faktor 10 verkürzt	*Highspeed, secondary rise and fall time shortened by a factor of 10*	x	x
PR	Polwender. Nur Leistungslos	*Polarity reversal. Only in standby*	x	x
FD	Freilaufdiode	*Freewheeling diode*	x	x
DDS	Entkopplungsdiode seriell	*Decoupling diode serial*	x	x
POP	Passiver Überspannungsschutz	*Passive overvoltage protection*	x	x
AOP	Aktiver Überspannungsschutz	*Active overvoltage protection*	x	x
USB Port	USB-Stick	*USB-Stick*	x	-
IIO	Erhöhte Isolation Ausgang gegen Erde 2000 DC bei einer Ausgangsspannung bis 300 VDC	*Increased insulation (2000 VDC) between DC output and earth at output voltages up to 300 VDC.*	x	x
E	Reduzierte Funktionen	*Reduced functions*	-	x
CC	Schutzlack für die Platinen	*Conformal coating*	x	x
LOCK AC	Interlock nach Maschinenrichtlinien für Netzeingang	*Interlock for mains input, according to machine guidelines*	x	x
LOCK DC	Interlock nach Maschinenrichtlinien für DC-Ausgang	*Interlock for DC output, according to machine guidelines*	x	x
EMO	Notabschaltung DC-Ausgang DC-Ausgang wird bei Netzabschaltung aktiv kurzgeschlossen	*DC output emergency off: The DC output is safely short-circuited when the mains supply is switched off.*	x	x
Option Puls	Ausgang kann periodisch abgeschaltet werden	Output can switch off periodically	x	x
SC	Sicherheitsabdeckung für Netz und DC-Anschlüsse	*Safety cover for mains and DC connections*	x	x
19"	19" Schrank inkl.Einbau und Verdrahtung der angebotenen DC-Quellen	*19" Cabinet including installation and wiring of the offered DC sources*	x	x
C	TFT-Touch Display [2]	*TFT-Touch display [2]*	x	
CE	TFT Display [2]	*TFT display [2]*	-	x
SD	SD Kartenleser, nur in Verbindung mit Option GD	SD-Slot, only with the option GD	x	-
3y	Garantieerweiterung auf 3 Jahre	Extended warranty 3 years	x	x
5y	Garantieerweiterung auf 5 Jahre	Extended warranty 5 years	x	x
2U	10 kW in 2 HE-Gehäuse	10 kW in 2 U Case	x	x
LCF	Filter Ableitstrom < 1 mA	Filter leakage current < 1 mA	x	x

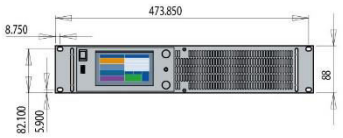
[1] maximal 3 digitale Schnittstellen
[2] verfügbar ab September 2020

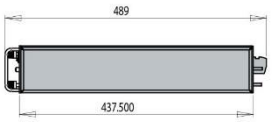
[1] *maximum 3 digital interfaces*
[2] *Available from september 2020*

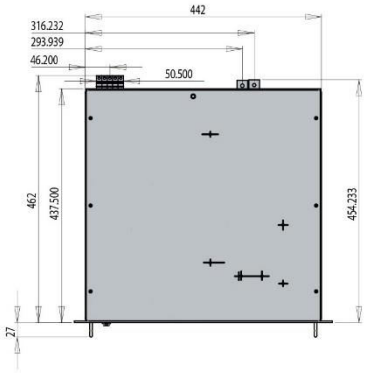
TECHNICAL DRAWING

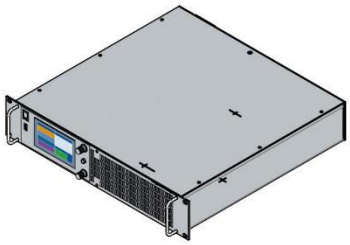
TECHNISCHE ZEICHNUNGEN
TECHNICAL DRAWINGS









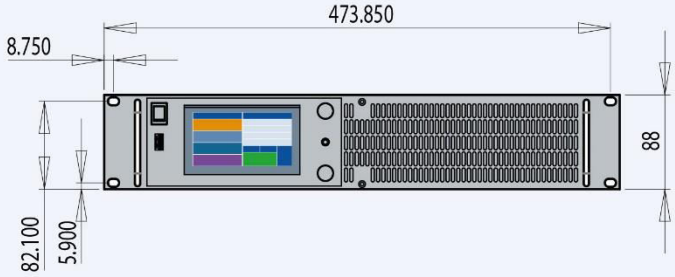


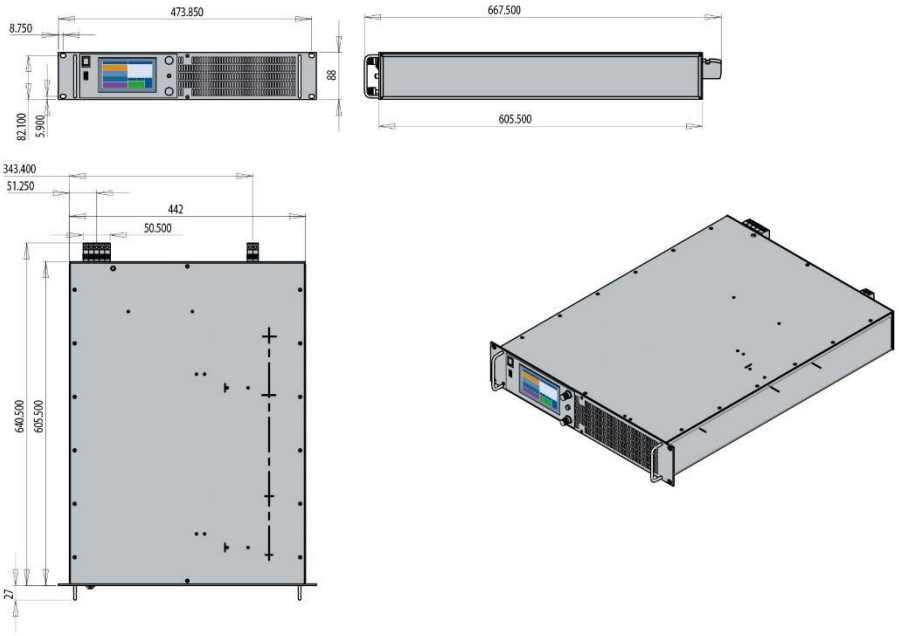
Die genaue Position der Schnittstelle kann vom Hersteller aufgrund verschiedener Geräteparameter geändert werden.
The exact position of the interface can be changed by the manufraturer due to different device paramteters.

Alle Angaben in mm
All values in mm

TECHNICAL DRAWINGS

TECHNISCHE ZEICHNUNGEN
TECHNICAL DRAWINGS





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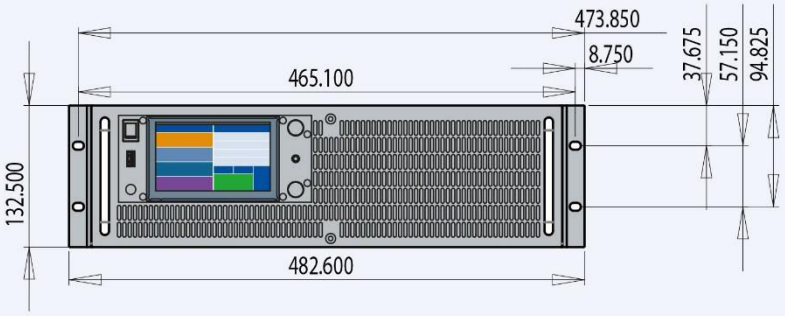
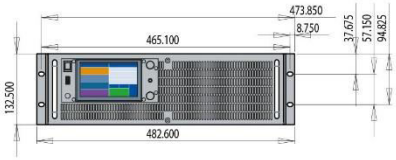
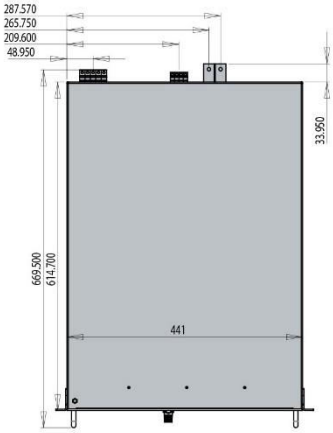
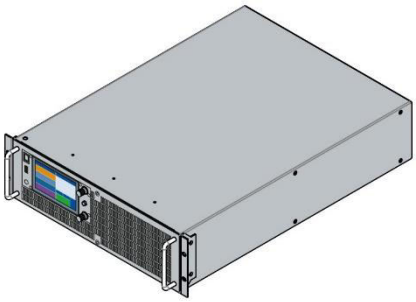
TECHNICAL DRAWINGS









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All values in mm

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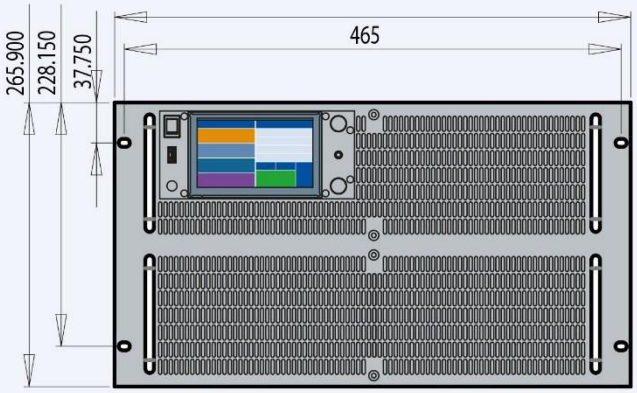
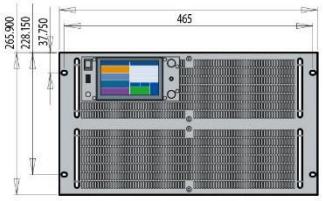
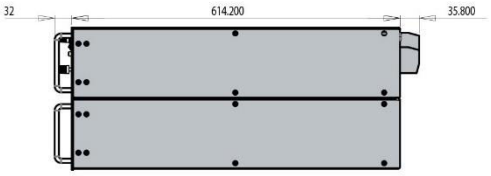
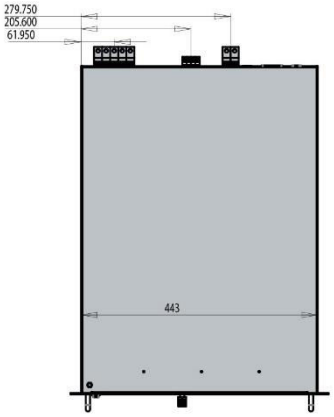
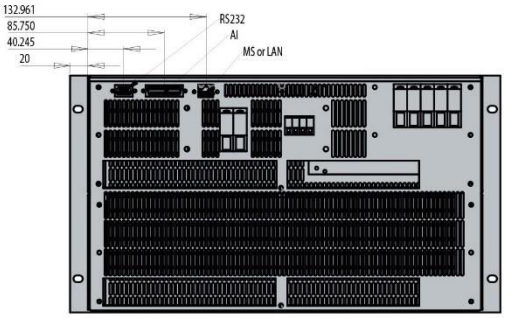
TECHNICAL DRAWINGS











The exact position of the interface
can be changed by the manufacturer
due to different device parameters

Die genaue Position der Schnittstelle kann vom Hersteller
aufgrund verschiedener Geräteparameter geändert werden.
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Alle Angaben in mm
All values in mm

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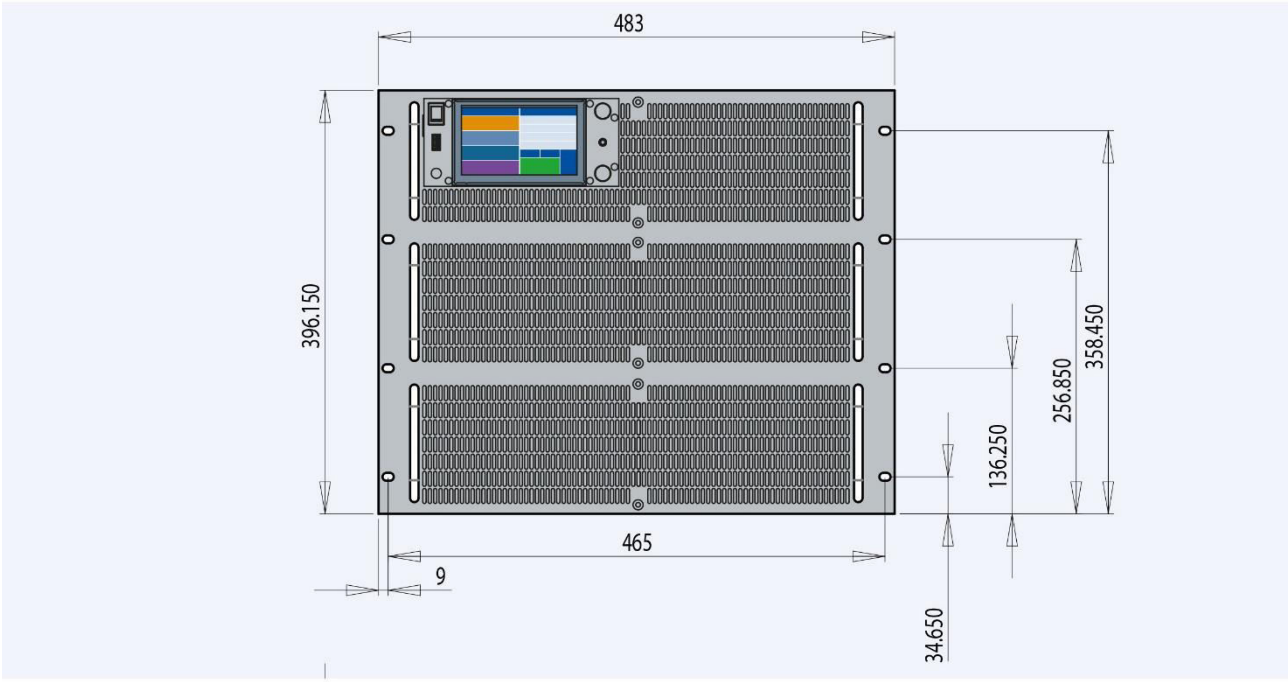
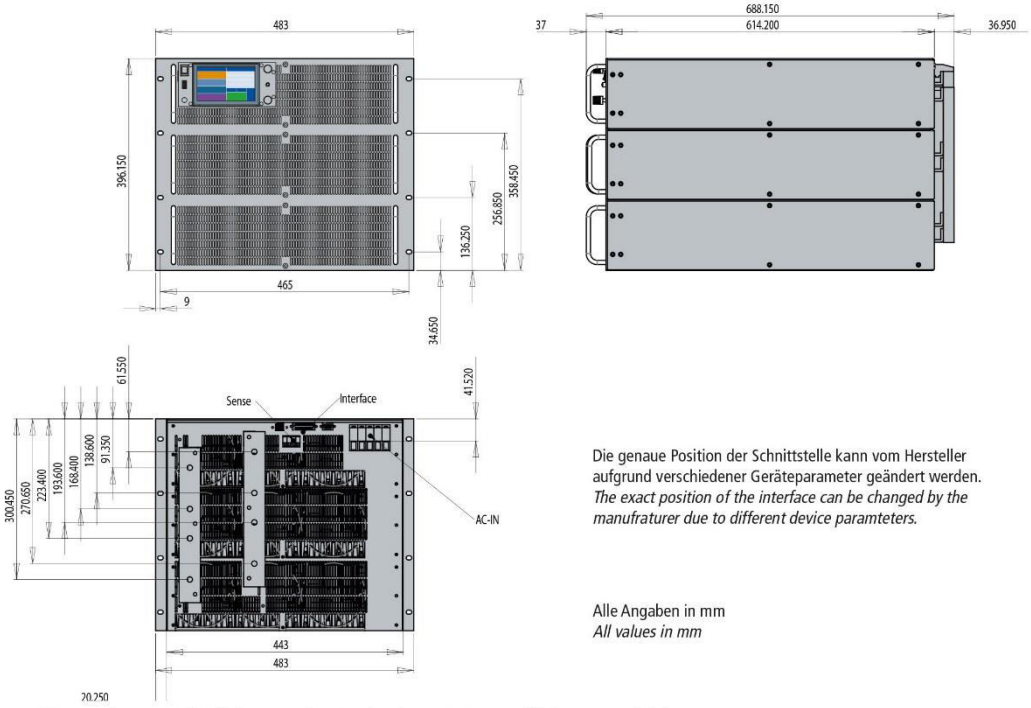
TECHNICAL DRAWINGS





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The exact position of the interface can be changed by the manufraturer due to different device paramteters.

Alle Angaben in mm
All values in mm

Important Safety Instructions

Please read this manual thoroughly before putting the device into operation. Pay regard to the following safety instructions and keep this manual nearby for future purpose.

This operating manual is based on the state of technology at the time of printing. However, it is possible that despite regular control and correction, the present document contains printing errors or deficiencies. ET System electronic GmbH assumes no liability for any technical, printing or translational errors within this manual.

Initial Operation

Unpacking

Please make sure that the shipping carton and the packaging is free of damage. If external damage is found, it is important to record the type of damage. Please keep the original packaging to ensure the device is adequately protected in case it needs to be transported in the future or claims for compensation need to be asserted.

Setting Up

To avoid electric shocks and product failure, the device should be installed in a temperature and humidity controlled indoor environment. The ambient temperature must not exceed 50 °C. The device must never be exposed to liquids or extreme humidity.

Visual Inspection

The unit must be examined immediately for defects or damages in transit. Damages caused during transport may be loose or broken control knobs and bent or broken connectors. Do not use the device if any physical damage is apparent. Please inform the carriers and a representative of ET System electronic immediately.

Mains Operation

Make sure to verify the model number and voltage stated on the nameplate. Damages due to wrong power feed are not covered by guarantee conditions.

The unit must only be operated when connected directly to the mains. To avoid damage, do not connect the unit to isolating transformers, auto-transformers, magnetic current limiters or similar devices.

MAINTENANCE INSTRUCTIONS

Service and maintenance can only be carried out by the manufacturer.
Only a dry cleaning cloth should be used to clean the unit.

FUNCTION TEST

To check that the unit's display is functioning properly, the unit's output voltage and current can be measured using suitable measuring equipment.

To test the voltage display, connect a suitable voltmeter directly to the open output terminals (no load connected) of the mains unit. It is useful to check the voltage at 10%, 50%, 90% and 100% of the maximum adjustable nominal voltage. If the measurement agrees with the display and the set voltage, the test is considered to be OK.

To test the current display, short-circuit the output of the power supply unit via a suitable shunt (current measuring resistor) and connect a suitable voltage measuring device to the shunt. It is useful to test the current at 10%, 50%, 90% and 100% of the maximum adjustable rated current. If the measurement agrees with the display and the set current, the test is considered to be OK.

INSTALLATION INSTRUCTIONS

If the unit is used in a way not specified by the manufacturer, the protection supported by the unit may be affected.

For safe operation of the unit, the protective earth conductor (PE) must be connected to the unit. For this purpose, the PE connection provided at the mains input and the earthing screw on the back are used. The following tables lists the required connection cables and the available connection bolts.

Earthing bolt	**HP**				
Uin | Pout	**3-10kW**	**5-15kW**	**21kW**	**22-45kW**	**46-63kW**
1x230 VAC	M5	x	x	x	x
3x208 VAC	M5	M6	M8	M8	M10
3x400 VAC	M5	M5	M6	M8	M10

Earth connection	**HP**							
Uin | Pout	**3-5kW**	**7-10kW**	**15kW**	**21kW**	**30kW**	**42kW**	**45kW**	**63kW**
1x230 VAC	6mm²	x	x	x	x	x	x	x
3x208 VAC	4mm²	10mm²	16mm²	35mm²	50mm²	95mm²	150mm²	185mm²
3x400 VAC	2,5mm²	6mm²	10mm²	16mm²	25mm²	50mm²	50mm²	70mm²

Protective element Single-core, free air

Table with the connection lines for the mains input:

Grid connection	Cross section por wire							
	HP							
Uin | Pout	**3-5kW**	**7-10kW**	**15kW**	**21kW**	**30kW**	**42kW**	**45kW**	**63kW**
1x230 VAC	6mm²	x	x	x	x	x	x	x
3x208 VAC	2,5mm²	6mm²	16mm²	25mm²	35mm²	70mm²	95mm²	150mm²
3x400 VAC	2,5mm²	4mm²	6mm²	10mm²	16mm²	25mm²	35mm²	50mm²

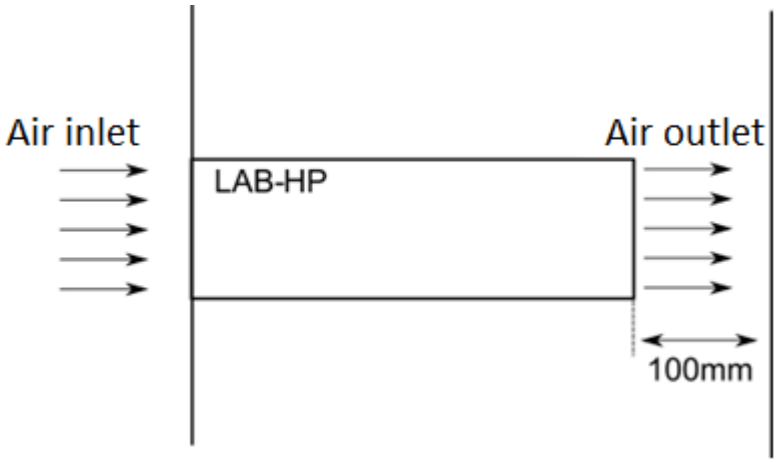
Multi-wire connection

If an external circuit breaker is to be used, it must be able to permanently carry at least the current specified in the table Input specifications +20%. If an external circuit breaker is used, it should be installed near the unit. The required overcurrent protection devices can be read from table Input specifications. The unit and the safety devices (fuses; circuit breakers) must be installed in such a way that they are easily accessible.

➔ Table Input specifications ist he table at the beginning oft he manual (page 2 and 3)

AIR SUPPLY AND INSTALLATION SITUATION OF THE SOURCE

The following picture shows the recommended installation situation of the source.



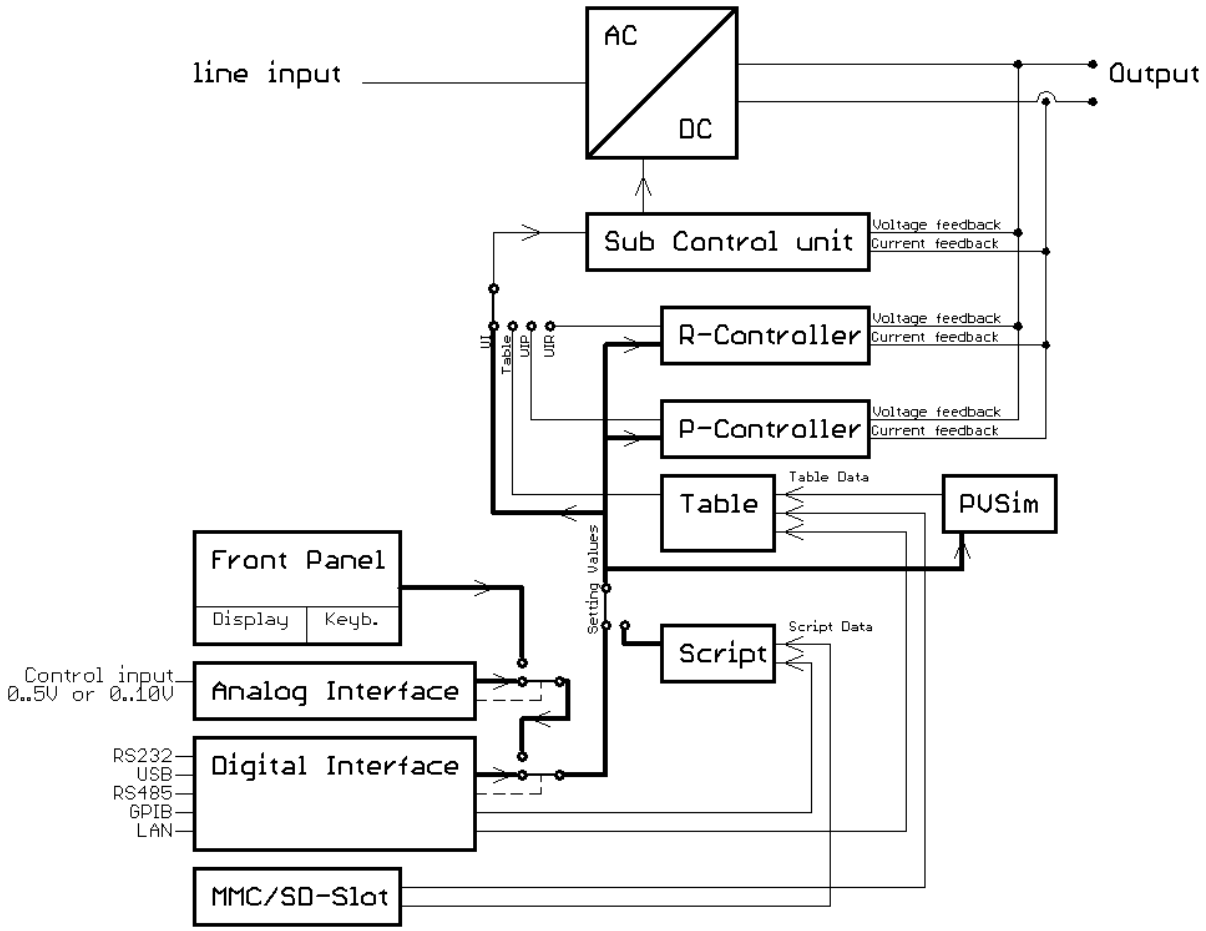
Air inlet volume = 310m³/h per 7.5kW module (maximum value)

INTEGRATION IN CUSTOMER APPLICATION

When installing the unit in a rack, make sure that there is a sufficient ventilation, because the surrounding temperature may increase, This may also affect the proper functioning of the unit.
The wiring of the unit must be done properly so that there are no danger points for people. The unit must be properly screwed down so that it cannot come loose.

FUNCTIONAL DESCRIPTION

The following block diagram gives information about the various adjustment options.



ATE-UNIT

An ATE unit has no front panel. It can be controlled via analogue interface (page 49 ff) or via universal interface (page 31 ff).

Example to control the LAB/HP over the universal interface:
Connect the device to the RS232 port (Page 25 ff, default parameter 9600Baud, 8 Data bits, 1 Stop bit, no parity, no handshake).
Start a terminal program (for example TeraTermPro).
Type following commands:

- ID (The LAB/HP will response his Id string)
- OVP,100(Set over voltage protection to 100V, no response)
- UA,10 (Set output voltage to 10V, no response)
- IA,1 (Set output current to 1A, no response)
- SB,R Enable the output, no response)
- MU (Read the actual output voltage)

Configuration of the AI interface via digital interface:

Syntax; AI[,{5|10}[,{UI|UIP}[,<Filterlevel>]]]

Parameter:
5, 10 5V- or 10V-Mode
IP, UIP UI-mode or UIP-Mode
Filterlevel range of values 0...10

Examples:
AI,10
AI,5,UIP
AI,10,UI,8

The changes are saved permanently.

FRONT PANEL OPERATION GRAPHIC DISPLAY

CONSOLE AND ROTARY PULSE ENCODER

The front panel consists of a rotary pulse encoder (with button function) and two buttons. The upper button switches the unit into standby or run mode.

The lower button changes the display mode. Pushing and holding this button for 2 second opens the interface configuration menu for interface settings (→ *Display and Settings*) and interface parameters (→ *Interface Parameter*).

The rotary pulse encoder adjusts the set value. Pushing the rotary pulse encoder selects the value to be changed.

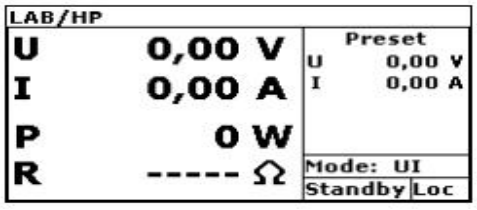
DISPLAY AND SETTINGS

MEASUREMENT (DISPLAY)

On the main screen, pushing the button ***Display*** switches between two different overview screens.

MAIN DISPLAY

The main display shows the current measuring and the set values. On the left side of this screen, the present voltage and current values are displayed as well as the resulting power (P = U * I) and resistance (R = U ÷ I). The set values are displayed on the right side of the screen (‚*Preset*') and vary according to the operation mode of the unit.



U	Output voltage
I	Output current
P	Output power (UIP mode only → *UIP mode*)
R_i	Internal resistance (UIR mode only → *UIR mode*)
U_{mpp}	MPP voltage (PV_{sim} mode only → *PV_{sim} mode*)
I_{mpp}	MPP current (PV_{sim} mode only → *PV_{sim} mode*)

The lower right section of the screen shows the current Control Mode of the unit:

Loc	Front panel operation
Scr	Memory card operation
AI	Analog interface operation
Rem	Interface operation
LLO	Interface operation, Front panel operation locked
Dis	Unit locked via interlock input (Option)

The section on the left of the control mode display shows the current Operating Status of the unit:

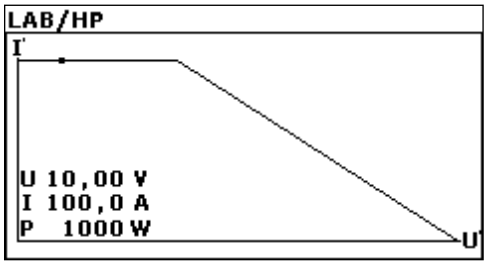
Standby	Standby mode
U-Limit	Voltage limitation mode
I-Limit	Current limitation mode
P-Limit	Power limitation mode
OVP	deactivation of the unit by over voltage protection mode

The section above the operating status display shows the current Operating Mode of the unit:

UI	Voltage and current limitation
UIP	Voltage, current and power limitation
UIR	Voltage and current limitation, simulated internal resistance-
PV_{sim}	simulation of a photovoltaic characteristic
User	simulation of a user-defined characteristic

UI DISPLAY

The output diagram is displayed as an UI characteristic. The picture on the right side shows the operating mode UIR. A small dot shows the actual operating point of the unit. The diagram is always relative to the selected values. For example, the current limitation would be changed from 100 A to 50 A, the internal resistance would be doubled, while the diagram would stay the same. A horizontal part of the diagram corresponds then to 50 A and not to 100 A.



OPERATING MODE SELECTION

Operating modes can only be selected when the main display is visible. Pushing the rotary pulse encoder switches the focus (selected mode is highlighted) through the different modes. Once the option is focused, the operating mode can be selected by turning the rotary pulse encoder. The unit needs to be in standby mode, otherwise the option ‚*Mode*' is not selectable.

PRESELECTABLE FIXED SETTINGS

Fixed settings can be saved and selected which means that front panel operation is inactive. For activation or deactivation, the button ***Standby*** must be pressed and held when the device is switched on until the ET-System logo fades out.

To activate the fixed settings, the device must be switched on and the option ‚Remember Last Setting' must be activated. The desired set values can be adjusted and the device must be switched off. The button ***Standby*** must be pressed and held while the device is switched on until the ET-System logo fades out. The device will load the last set values directly on power up. Front panel operation is inactive. This status is signalized by the word ‚Dis' in the lower right corner of the display. To deactivate this mode, the button ***Standby*** must be pressed when switching on the device.

OPERATING MODE DESCRIPTION

There are basically 5 different modes, which can be selected. They work as follows:

UI MODE

In UI mode, the set values for voltage and current are transferred directly to the switch mode regulator. There is no additional digital control.

UIP MODE

In UIP mode, the set values for voltage and current are transferred directly to the switch mode regulator. If the output current exceeds the previously adjusted limit value, the current set point will be regulated.

UIR MODE

In UIR mode, the voltage set point is regulated in a way that a power supply unit with (adjustable) internal resistance is simulated. The set value for current limiting is transferred directly to the switch mode regulator.

PV_{SIM} MODE

In PV_{sim} mode, the diagram of a PV generator is simulated. Given values are open-circuit voltage U_o, short-circuit current I_k, as well as the amounts of voltage and current by which the PV generator delivers the maximum power (U_{mpp}, I_{mpp}). Parameters can be found in the specification sheet of the simulated PV generator.

Values for U_{mpp} may be in a range from 0.6 to 0.95 * U.
Values for I_{mpp} may be in a range from 0.6 to 0.95 * I.

SCRIPT MODE

In script mode, the unit is controlled by memory card. The display ‚*Mode*' shows the present operating mode ‚*UI*'. The lower right corner of the display shows the word ‚*Scr*', which indicates that script operation was selected. If there is no memory card in the slot, this option cannot be selected. For detailed information about memory card control and about how to build up a script, see → *Script Control*.

GENERAL SETTINGS

CONFIGURATION

The configuration menu can be accessed by holding the button ***Display*** (lower button) for at least 2 seconds. This opens a menu where general settings of the unit can be changed.
At first it will show the ID, serial number and maximum parameters of the device.
By pressing the ***Display*** button again, it switches to the config menu. These settings can be made: U_{limit}, I_{limit}, U_{slope}, I_{slope}, OVP, UVP and t(UVP).
If the ***Display*** button is pressed again, the next page is shown, with the following settings: OCP, t(ocp), Remember setting, t Enable, Lang, AI-Type, AI filter level and M/S-Mode.
Pushing the rotary pulse encoder selects individual parameters. Turning the rotary pulse encoder selects the desired value.
Pushing the button ***Display*** a fourth time, opens the configuration menu for digital interface parameters.
To leave the configuration menu, just press ***Display*** again and the device returns to the main screen.

CONTRAST

After the unit has been switched on, the display shows the ET System logo. In this time, the contrast of the display can be adjusted by using the rotary pulse encoder. Afterwards, the contrast will be saved automatically and the system continues with the booting process.

VOLTAGE SETTINGS

U_{LIMIT} AND I_{LIMIT}

U_{limit} limits the maximum output voltage. The output voltage is limited to the selected value, irrespective of the values that have been set at the front panel or at one of the interfaces. The adjustment range is 0V up to the maximum rated voltage of the device.

I_{limit} limits the maximum output current. The output current is limited to the selected value, irrespective of the values that have been set at the front panel or at one of the interfaces. The adjustment range is 0A up to the maximum rated current of the device.

These settings can only be changed at the display and they apply to all interfaces.

U_{SLOPE} AND I_{SLOPE}

U_{slope} creates a ramp, which the device will perform, when leaving the standby. This ramp can be set between OFF up to (U_{max}*0.03)V/s and is set in 1V steps.

I_{slope} creates a ramp, which the device will perform, when leaving the standby. This ramp can be set between OFF up to (I_{max}*0.03)A/s and is set in 1A steps.

OVP (OVER VOLTAGE PROTECTION)

The output is shut immediately if the output voltage exceeds the selected value. The display indicates this status with the word *‚OVP'*. To reset this error, push the button ***Standby***. The OVP value applies to the front panel operation. There may apply different values for the AI-interface and the digital interface. The digital interface is initialized with the value which has been adjusted on the front panel. The adjustment range is 0V up to the maximum rated voltage of the device + 20%.

UVP (UNDER VOLTAGE PROTECTION)

The output is shut immediately if the output voltage drops below the selected value. The display indicates this status with the word *‚UVP'*. To reset this error, push the button ***Standby***. The UVP value applies to the front panel operation. There may apply different values for the AI-interface and the digital interface. The digital interface is initialized with the value which has been adjusted on the front panel. The adjustment range is 0V up to the maximum rated voltage of the device.

T(UVP)

The t(UVP) setting represents the **t**ime in ms until the UVP is triggered. It can be set from 100ms up to 1000ms.

OCP (OVER CURRENT PROTECTION)

The output is shut immediately if the output current exceeds the selected value. The display indicates this status with the word *‚OCP'*. To reset this error, push the button ***Standby***. The OCP value applies to the front panel operation. There may apply different values for the AI-interface and the digital interface. The digital interface is initialized with the value which has been adjusted on the front panel. The adjustment range is 0A up to the maximum rated current of the device + 20%.

T(OCP)

The t(OCP) setting represents the **t**ime in ms until the OCP is triggered. It can be set from 1ms up to 5000ms.

REMEMBER LAST SETTING

If this option is activated (*‚On'*), selected parameters will be kept after a blackout. If this option is deactivated (*‚Off'*), standard setting (0V/0A/UI-Mode) will be loaded after supply voltage is enabled.

T ENABLE

The t Enable setting represents the **t**ime in ms, which the device keeps On after leaving standby. After the time is over, the devices switches back into standby. It can be set from Infinite up to 65000ms.

LANG

The Lang setting is the short form of language. Here you can select the desired language of the device.

AI-TYPE

This feature adjusts the voltage levels of analog input signals and analog output signals. Selectable ranges are 0-5 V and 0-10 V.

AI FILTER

It can be set from 0 up to 15.

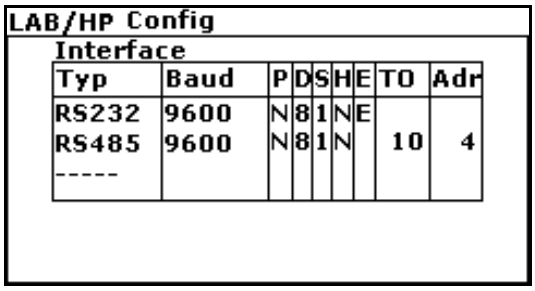
M/S Mode

The following adjustments can be made if M/S-Mode is activated (→ *Master/Slave-Mode*):

Off	no master/slave
Parallel	parallel connected outputs
Serial	serial connected outputs
Independent	Independent outputs, change of set values via bus only

Interface parameter (Option)

The display shows all available digital interfaces and their changeable parameters. These parameters can be selected by pushing the rotary pulse encoder and changed by turning the rotary pulse encoder (function of the parameters → *Universal Interface*).



FRONT PANEL OPERATION TFT TOUCH DISPLAY

USER INTERFACE

When the unit is switched on, the main user interface is displayed after booting up. It is structured as follows:

- At the top of the screen, you will find the unit designation
- On the left side, under the heading "Monitor", you will find the current measured values of the unit output.
- On the right-hand side, under the heading "Preset", you will find the current set values.
- In the lower right corner of the screen, one finds:
- The current operating mode of the unit (front or interface operation).
- The status of the output (standby, constant current, constant voltage)
- The "Standby" button with the states "Off" and "On".
- The current mode of the unit (UI, UIP, UIR, ...)

Pressing the set value of the voltage or current opens a number field for entering the desired voltage or current.
The entry is made as follows:

- Enter the desired value in the number field
- Confirm the entry with the Enter key (arrow at the bottom right).
- Correct the entry with the delete key (arrow at the top right).
- Exit the number field, if the value is not to be changed, by pressing outside the number field.

The set value can also be entered at any time using the rotary encoder located to the right of the display.
By pressing the "Standby" button or the standby button to the right of the display, the unit output is enabled and, depending on the load, the preset values are set. The current measured values of voltage, current, power and load resistance are displayed on the left.
By pressing the "Standby" button again, or the standby button, the unit output is disabled again.
Pressing the "Mode" button during operation takes you to the graphs (see Chapter 2.1).

MODE SELECTION

By pressing the „mode button or the upper rotary encoder in standby, the available modes appear at the top of the screen. These can be selected by clicking on them. Alternatively, you can navigate through the menu by turning the upper rotary encoder and confirm the selection by pressing it.

UI MODE

In UI mode, the output voltage and current can be defined. This mode is selected as the default setting.

UIP MODE

In UIP mode, in addition to voltage and current, the maximum power can be preset. This preset power limit cannot be exceeded by the unit.

UIR MODE

In UIR mode, in addition to voltage and current, a simulated internal resistance can be set.

PVSIM

In PVSim mode, in addition to voltage and current, a voltage and current operating point can be set. This mode is used for photovoltaic simulation.

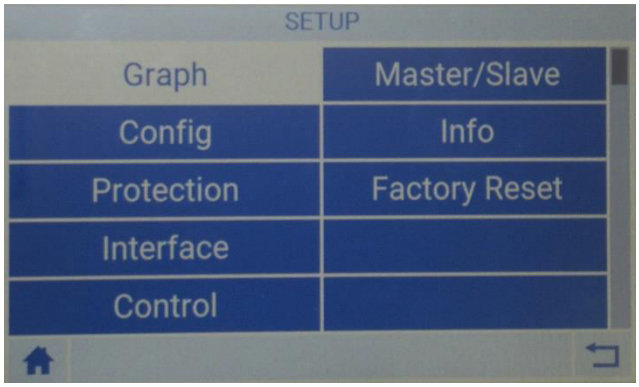
USER MODE

In user mode, scripts stored on the USB stick inserted in the front can be used.

SCRIPT

In script mode, scripts on the USB stick inserted in the front can be viewed and managed.
Settings

SETUP MENU

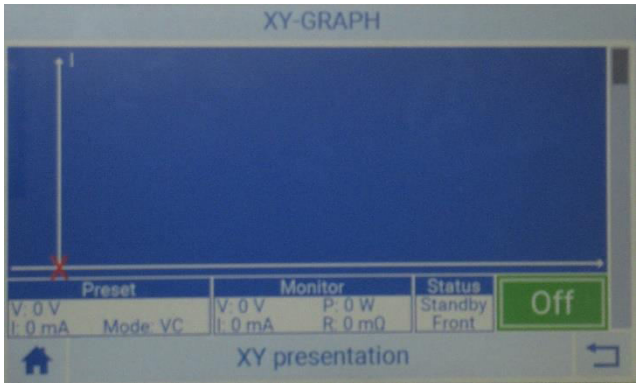


By pressing the "Mode" button or the upper rotary encoder in standby, the item "Config." appears at the top of the screen. Clicking on this point or pressing the upper rotary encoder again takes you to the settings.
You can exit the settings either by pressing the "Back" button in the lower right corner or by pressing the "Home" symbol in the lower left corner. The "Back" button takes you to the previous view and the "Home" symbol takes you directly back to the main user interface. The lower rotary encoder works like the "Back" button as well.

GRAPH MENU

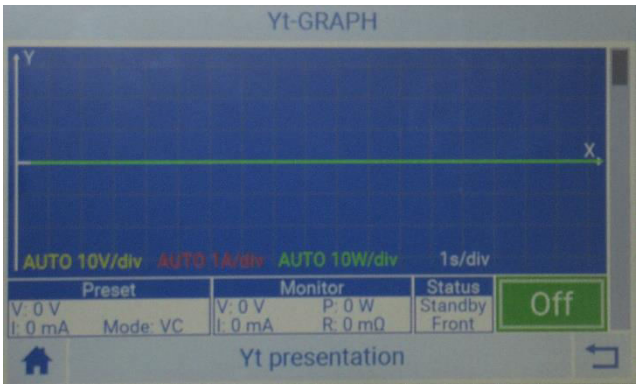
In the graph menu, you can choose between 2 different views that show the current unit output. You can switch between the views by clicking on the graph or pressing the upper rotary encoder.
Below the graphs on the left are the set values, which can still be changed via the rotary encoder.
To the right are the currently measured output values and a "standby" button for enabling or disabling the unit output.
If you press the "Mode" button or the upper rotary encoder during operation while on the main user interface, you will also get to the graph menu.

XY REPRESENTATION



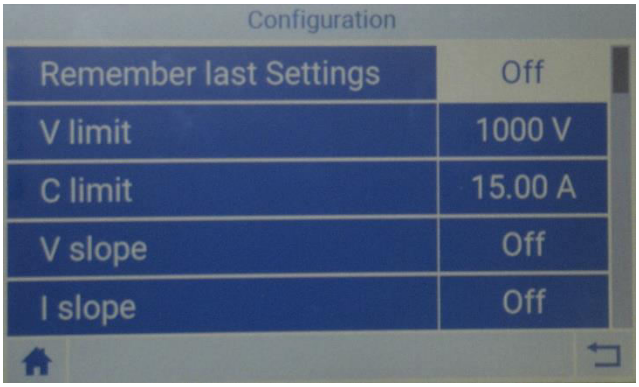
In this representation, the current I is plotted on the Y-axis and the voltage U on the X-axis. The red frame represents the maximum limits determined by the set values. A red X symbol represents the current operating point.

YT REPRESEÜNTATION



In this representation, the current I, the voltage U and the power P are plotted on the Y-axis and the time t on the X-axis. The resolution is set automatically here. In operation, the graph is updated every 0.5s and thus runs from right to left. In standby, the recording is stopped.

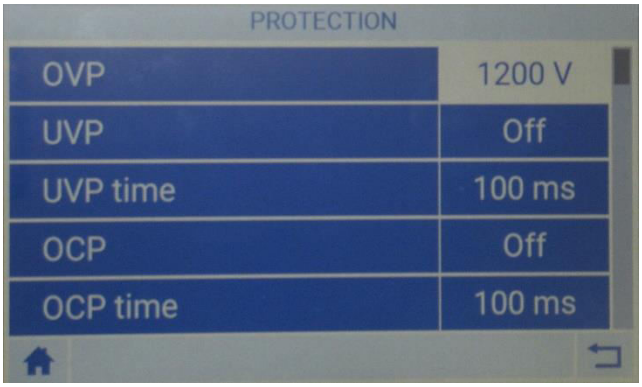
CONFIGURATION



The basic settings for the unit can be made here.

- Remember settings: Saves the last settings, even after switching off.
- U Limit: Setting of the maximum voltage set value
- I Limit: Setting of the maximum current set value
- U Rise: Rise time of the output voltage in V/s
- I rise: rise time of the current in A/s
- Switch-on delay: setting of a switch-on delay in seconds after leaving standby
- T on: Setting the time in seconds how long the unit remains active after leaving standby
- Data logger: Setting the time steps in seconds from OFF to 100, in which the measured output values are recorded on the USB stick inserted in the front.
- Interlock: Setting the level of the interlock (high or low active).
- Language: Setting the language

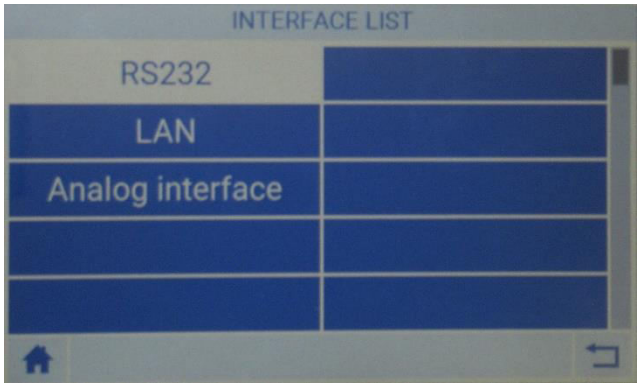
PROTECTION SETTINGS



Here you can make the security settings on the unit.

- OVP (Over Voltage Protection): Setting the voltage in V, above which the unit switches to standby.
- UVP (Under Voltage Protection): Setting the voltage in V below which the unit switches to standby.
- UVP Time: Setting of the UVP's triggering time.
- OCP (Over Current Protection): Setting of the current in mA, above which the unit switches to standby.
- OCP Time: Setting the trigger time of the OCP

INTERFACES



All built-in interfaces are displayed and managed here.

ANALOGUE INTERFACE

The analogue interface can be configured under this menu item.

- AI Level: Setting the signal level in 5V or 10V with which the AI is operated.
- AI Mode: Setting of the mode in which the AI is to be operated.
- AI Filter: Setting the AI filter level for the set values in seconds from 0-80

RS232 INTERFACE

Under this menu item, the RS232 interface can be configured.

- Baud rate: Setting the baud rate from 0 to 115200
- Parity: Setting the parity (none, even, odd)
- Databits: -
- Stop bits: Set the stop bits from 1 to 2.
- Handshake: Setting the handshake (none, hardware, software)
- Echo: Setting the echo ("E"-cho and "N"-o echo)
- Timeout: -
- Address: -

LAN INTERFACE

The LAN interface can be configured under this menu item.

- Baud rate: -
- Parity: -
- Databits: -
- Stop bits: -
- Handshake: -
- E: -
- Timeout: -
- Address: -

USB INTERFACE

The USB interface can be configured under this menu item.

- Baud rate: Set the baud rate from 0 to 115200.
- Parity: Set the parity (none, even, odd).
- Databits: -
- Stop bits: Setting the stop bits from 1 to 2.
- Handshake: Setting the handshake (none, hardware, software)
- Echo: Setting the echo ("E"-cho and "N"-o echo)
- Timeout: -
- Address: -

RS485 INTERFACE

Under this menu item, the RS485 interface can be configured.

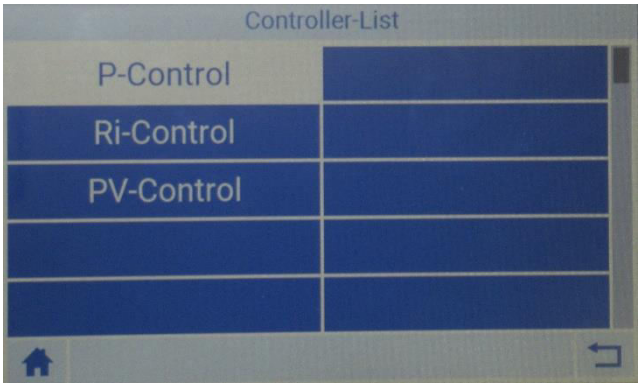
- Baud rate: Set the baud rate from 0 to 115200.
- Parity: Set the parity (none, even, odd).
- Databits: -
- Stop bits: Setting the stop bits from 1 to 2.
- Handshake: -- E: -
- Timeout: Setting the timeout from 0ms to 100ms
- Address: Setting the unit address from 0 to 255

GPIB INTERFACE

Under this menu item, the GPIB interface can be configured
Baud rate: -

- Parity: -
- Databits: -
- Stop bits: -
- Handshake: -- E: -
- Timeout: -
- Address: Setting the address from 0 to 31

CONTROLLER



Here, the digital PID controllers of the individual modes can be readjusted and thus adapted to the respective application. The values to be set range from 0 to 9.9999. The higher the value set, the greater the range of influence of the respective controller.

P-CONTROLLER

This menu item is used to set the digital PID controller for the UIP mode.

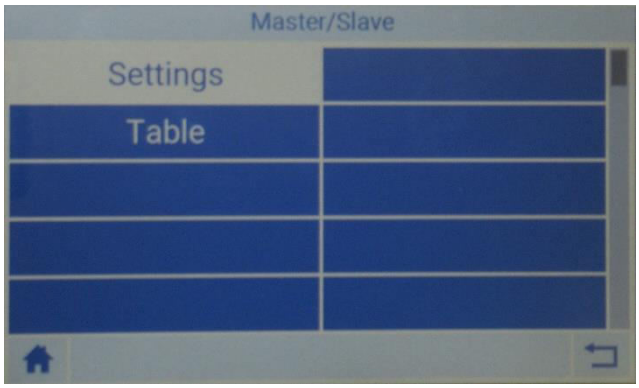
RI CONTROLLER

This menu item is used to set the digital PID controller for UIR mode.

PV CONTROLLER

This menu item sets the digital PID controller for PVSim mode.

MASTER/SLAVE



Here the master/slave properties of the units can be set and the units connected in the master/slave can be displayed.

SETTINGS

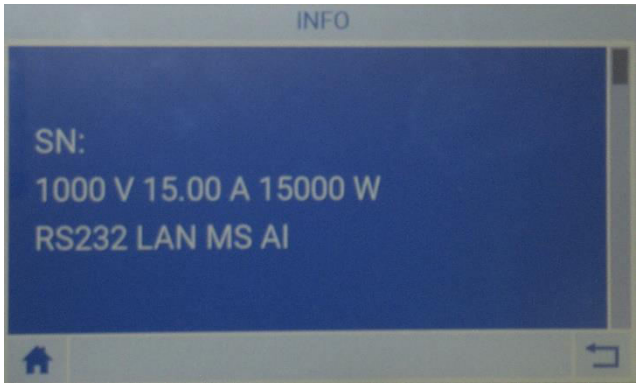
This menu item is used to set the master/slave operation of the unit. The following settings can be selected:

- Off: The unit does not operate in Master/Slave mode.
- Serial: Set if the units are connected in series at the respective unit output.
- Parallel: Set when the units are connected in parallel at the respective unit output.
- Independent: Set if the units at the respective unit output are connected to each other in a matrix.

TABLE

Under this menu item, all units that are currently connected to each other via the master/slave interface are displayed with their respective, assigned ID,
with their respective, assigned ID. By swiping up or down over the table, you can scroll up or down. Alternatively, this is also possible by turning the upper rotary encoder.
In addition, the voltage, current and output power supplied by the respective unit are shown in the table. The lowest static line shows the sum of these values.

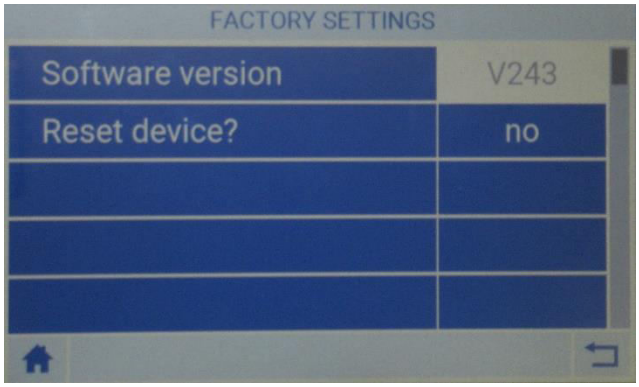
INFO



Here you can find all hardware information about the unit. This information includes:

- Device type
- Serial number
- Maximum output voltage/current/power
- Built-in interfaces

FACTORY SETTING



Here the unit can be reset to factory settings. This includes all changes made to the unit by the customer (note: the controller values are also deleted).
The currently installed software version can also be displayed

UNIVERSAL INTERFACE (OPTION)

All interfaces of the digital interface are equal. There is no shift between the interfaces. For example, the first command can be issued via the IEEE interface while the second command can be issued via the RS232 interface. The return values will be sent from that interface the command was issued from.

COMMANDS

Communication is based on an ASCII protocol. The following chapters describe how to write a command and give an overview over the commands.

FORMAT

A command consists of the command word, a parameter (if necessary) and a terminator. The character for the terminator is Carriage Return ***<CR>*** or Line Feed ***<LF>***.

Character	ASCII	Dec value	Hex value
Carriage Return	<CR>	13	0d
Line Fee	<LF>	10	0a

If the command contains a <DEL> or <ESC> character, it will not be processed. Therefore, a command can be cancelled while entering. Though, a terminator (***<CR>*** or ***<LF>***) is necessary.

Character	ASCII	Dec value	Hex value
Escape	<ESC>	27	1b
Delete	<DEL>	127	7f

Commands are not case sensitive and may be mixed up. Therefore, the effect of the following commands is the same: GTL, Gtl, gTL. Decimal places are optional and separated by a full stop '**.**' . The number of decimal places is not limited. Therefore, the effect of the following commands is the same: UA,10, UA,10.0, UA,10.000000000, UA,0010, UA,010.0000

The number of decimal places to be analyzed depends on parameter and unit type. It corresponds to the number of decimal places, a command without a parameter would return. As a rule, decimal places are analyzed until a resolution of 0.1% is reached.

Example: Evaluation of decimal places

LAB/HP with 600 V, 25 A
600 V * 0.1 % = 0.6 V → one decimal place
25 A * 0.1 % = 0.025 A → three decimal places

Optional, after a numerical value, a letter may be added to indicate the unit. However, this letter will not be analyzed.

Example: Attached letter as unit

UA,10.0 V → Resets output voltage to 10 V
UA,10.0 m → Caution! The ‚m' will not be evaluated, output voltage here is also 10 V

Example: A valid command with corresponding hex values

U	A	,	1	0	.	2	<CR>
55 h	41 h	2 ch	31 h	30 h	2 eh	32 h	0 dh

Example: Adjustment of output voltage 10 V/5 A (full command sequence)

OVP,100 → adjusts OVP to 100 V
UA,10 → adjusts output voltage to 10 V
IA,5 → current limiting 5 A
SB,R → output enabled

INSTRUCTION SET

The IEEE-488.2 standard demands several basic commands. Some commands may occur twice for compatibility reasons (once in the ETS version and once in the (old) IEEE-488.2 version). The following syntax is used to describe the commands:

[]	Square brackets	→ optional parameter
<>	Angle bracket	→ numerical value
{}	Curly bracket	→ selection list
|	Vertical line	→ separator within selection list

Example

GTR[,{0|1|2}] means that the command GTR can be used with or without parameters. If a parameter exists, it has to be 1, 2 or 3. Valid commands are: GTR GTR,1 GTR,2 GTR,3
IA[,<imax>] means that the command IA can be used either with or without parameters. If a parameter exists, it has to be a numerical value.

QUICK VIEW OF COMMANDS

Command	Description	Result
CLS* or CLS	Clear Status	Deletes the status byte
DAT,<U>,<I>	DIP	Data for user-defined characteristic
DCL	Device Clear	Initialization data reset
GTL	Go To Local	Activates front panel operation
GTR[,{0|1|2}]	Go To Remote	Activates digital interface operation
IA[,<imax>]	Set I_{max}	Adjusts current limiting
ID or *IDN?	Identification	Displays identification string
IMPP[,<impp>]	Set I_{mpp}	Adjusts MPP current during PVsim mode.
LLO	Local Lockout	Deactivates LOCAL button
LIMI	Limit I_a	Reads maximum adjustable current limitation
LIMP	Limit P_a	Reads maximum unit output.
LIMR	Limit R	Reads adjustable range for R_i within UIR mode.
LIMRMAX	Limit R_{max}	Reads maximum adjustable range for R_i within UIR mode.
LIMRMIN	Limit R_{min}	Reads minimum adjustable range for R_i within UIR mode.
LIMU	Limit U_a	Reads maximum adjustable voltage limitation
MODE[,{UI|UIP|UIR|PVSIM|USER|Skript}]	Set Mode	Selects operation mode
MU[,<Nr>]	Measure U_a	Measures present output voltage
MI[,<Nr>]	Measure I_a	Measures present output current
*OPT?	Optional Identification Query	Displays units current hardware/software version
OVP[,<U_{ovp}>]	Overvoltage Protection	Adjusts over voltage protection
PA[,<P_{limit}>]	Set P_{max}	Adjusts power limitation
PCx[,<baud>,<parity>,<data bits>,<stop bits>,<handshake>,<echo>,<timeout>]	Program Communication	Adjusts the interfaces
RA[,<R_i>]	Set R_i	Adjusts internal resistance
REGLER[,<Nr>,<Kp>,<Ki>,<Kd>]	Controller Parameters	Adjusts controller parameters for UIP, UIR and PVsim mode
RI or *RST	Reset Instrument	Resets hardware (no return value)
SB[,{S|R|1|0}]	Standby	Enables/blocks the output
SCR[,<CMD>[,<value>]]	Load Script	Programming of script memory
SS or *PDU	Save Setup	Saves previously made channel and interface parameter adjustments (no return value)
STATUS	Status	Query of the units status (return values in binary format) (also see following table)
STB or *STB?	Interface Status	
UA[,<ua>]	Set U_a	Adjusts output voltage (if there are no parameters, present set point is displayed)
UMPP[,<umpp>]	Set U_{mpp}	Adjusts MPP voltage in PV_{sim} mode (if there are no parameters, present set point is displayed)
WAVE	End Userwave Data	Ends transfer of user-defined output characteristic (gradual interpolation of intermediate values)
WAVELIN	End Userwave Data	Ends transfer of user-defined output characteristic (linear interpolation of intermediate values)
WAVERESET,<Um>,<Im>	Start Userwave Data	Starts transfer of user-defined output characteristic

DETAILED DESCRIPTION OF COMMANDS

CLS* OR CLS - CLEAR STATUS

This command deletes the status byte. It affects only the status byte of the interface, the command was sent from. No return value. For detailed description of the status byte see the different interface chapters.

DAT,<U>,<I> - DATA

Data for a user-defined characteristic. No return value. For detailed description of this command see → *Wavereset*.

DCL - DEVICE CLEAR

This command resets the initialization data. No return value.
Caution: Interface parameters are also reset!

GTL - GO TO LOCAL

This command activates front panel operation. If ‚Local Lockout' (LLO) was activated before, it will also be reset. No return value.

GTR[,{0|1|2}] - GO TO REMOTE

This command activates digital interface operation. The optional parameter affects the future behavior of the unit after switch on. Setting is saved permanently. No return value.

Optional parameter 0 = Deactivates automatic remote operation
The command GTR must be entered to activate the unit's remote operation mode. This mode is useful if the unit shall be operated manually and at the same time, measurement values shall be read out via the digital interface.

Optional parameter 1 = Activates remote operation on first addressing
Unit switches to remote operation when receiving a command via digital interface. The only exception is the GTL command, which switches the unit to local mode.

Optional parameter 2 = Activates remote operation immediately after switch on
After the unit was switched on, remote mode is immediately activated. Front panel operation is deactivated.

IA[,<imax>] - Set I_{max}

This command adjusts current limiting. Entering the command without parameters displays the set value. If the set value is higher than the maximum current of the unit, the range-error-bit within the ESR register of the interface is set. The present set value remains unchanged. If the set value is higher than the I_{limit} value, which was adjusted by the user's settings, but lower than the maximum current of the unit, the current is limited to the I_{limit} value. No error message.

Example: 300 A unit, I_{limit} adjusted to 200 A via configuration menu

GTR	Remote operation
OVP,200	Over voltage protection 200 V
UA,10	Output voltage 10 V
IA,100	Output current 100 A
SB,R	Output open
IA,400	Output current 400 A, this command is ignored, because the current is higher than the maximum current of the device. „Rangeerror" is set within the status byte.
IA,250	Output current 250 A, since the output current was limited to 200 A via configuration menu, current limiting is set to 200 A. Error bit is not set.
IA	Query of the adjusted current.
IA,200.0A	Unit answers: I_{limit} = 200 A

In master/slave mode, the current of a programmed device is adjusted. Connected in parallel, the total current is n x IA.

Example:

In M/S mode, 3 devices are connected parallel. IA,10 programs an output current of 10 A. All connected devices are set to 10 A. Since 3 devices have been connected parallel, the total current is 3 x 10A = 30A.

ID OR IDN? - IDENTIFICATION

This command displays the identification string. Return value: <ID-String>.

IMPP[,<IMPP>] - SET I_{MPP}

This command adjusts the MPP current for PV_{sim} mode. Entering the command without parameters displays the set value. If the set value is higher than the maximum current of the unit, the range-error-bit within the ESR register of the interface is set. The present set value remains unchanged. If the set value is higher than the I_{limit} value, which was adjusted by the user's settings, but lower than the maximum current of the unit, the current is limited to the I_{limit} value. No error message follows.

Example:

GTR	Remote operation
OVP,200	Over voltage protection
UA,50.5	Open circuit voltage of a 50.5 V simulated PV generator
IA,10	Short circuit current of a simulated 10 A PV generator
UMPP,40.4	MPP voltage of a simulated 40.4 V PV generator
IMPP,8.2	MPP current of a simulated 8.2 A PV generator
MODE,PVSIM	Activates PV simulation mode
SB,R	Output open

In master/slave mode, the current of a programmed device is adjusted. In parallel connection the total current is n x IA.

LIMI - LIMIT I_A

With this command the user can read the maximum adjustable current limiting.

Example: 300A unit, I_{limit} was adjusted to 200 A via configuration menu

LIMI	Query of maximum adjustable current
LIMI,200.0A	Unit answers: I_{limit} = 200 A

LIMP - LIMIT P_A

With this command the user can read the unit's maximum output.

Example: 10 kW unit

LIMP	Query of units output
LIMP,10000	Unit answers: 10 kW

LIMR - LIMIT R

With this command the user can read the adjustable range for R_i within UIR mode.

Example:

LIMR	Query of adjustable internal resistance
LIMR,0.015R,1.00R	Unit answers: 15 mOhm up to 1 Ohm

LIMRMAX - Limit R_{max}

With this command the user can read the maximum adjustable range for R_i within UIR mode.

Example:

LIMRMAX	Query of maximum adjustable internal resistance
LIMRMAX,1.000R	Unit answers: 1 Ohm

LIMRMIN - LIMIT R_{MIN}

With this command the user can read the minimum adjustable range for R_i within UIR mode.

Example:

LIMRMIN	Query of minimum adjustable internal resistance
LIMRMIN,0.015R	Unit answers: 15 mOhm

LIMU - LIMIT U_A

Reads maximum adjustable voltage limitation. This command requests the previously defined maximum output voltage.

Example: 300 V unit was adjusted to 200 V via configuration menu

LIMU	Query of maximum adjustable current
LIMU,200.0V	Unit answers: U_{limit} = 200 V

LLO - LOCAL LOCKOUT

This command deactivates the ***Local*** button. Unit cannot be switched to local mode by holding the button ***Standby***. No return value.

MI[,<NR>] - MEASURE I_A

This command measures the present output current.

Example:

GTR	Remote operation
OVP,200	Over voltage protection 200 V
UA,10	Output voltage 10 V
IA,1	Output current 1 A
SB,R	Output open
MI	Measures present output current
MI,0.567A	Unit answers: 567 mA

In master/slave mode with parallel connection the total current of all connected devices is displayed. Using the parameter <Nr> will show the value of each connected device. Numbering starts with 0.

Example:

MI,2 displays the measured output current at the bus of device number 3.

MODE[,{UI|UIP|UIR|PVSIM|USER|SKRIPT|0|1|2|3|4|5}] - SET MODE

This command selects the operation mode. Entering the command without parameter displays the presently selected operation mode. Entering the command with parameter activates the operation mode. Alternatively, the operation mode can be indicated as number.

The following table shows the different settings:

Command	Function
MODE,UI MODE,0	UI mode is activated
MODE,UIP MODE,1	UIP mode is activated
MODE,UIR MODE,2	UIR mode is activated
MODE,PVSIM MODE,3	PV_{sim} mode is activated
MODE,USER MODE,4	User-defined UI characteristic is activated. The characteristic is defined with the commands ***DAT***, ***WAVE***, ***WAVELIN*** and ***WAVERESET***.
MODE,SKRIPT MODE,5	Script mode is activated. The script is read from the memory card or loaded after the command SCR has been entered.

MU[,<NR>] - MEASURE U_A

This command shows the measurement value of the present output voltage.

Example:

```
GTR             Remote operation mode
OVP,200         Over voltage protection 200 V
UA,10           Output voltage 10 V
IA,1            Output current 1 A
SB,R            Output open
MU              Measures present output voltage
MU,10.0V        Unit answers: 10 V
```

In master/slave mode with serial connection the total current of all connected devices is displayed. Using the parameter <Nr> will show the value of each connected device. Numbering starts with 0.

Example:

MU,1 displays the measured output voltage at the bus of device number 2.

*OPT? - Optional Identification Query

This command does an optional identification query, which means it displays the software version.

Example:

```
*OPT?           Query of version number
08.06.2012 V42  Unit answers: Version 42 vom 08.06.2012
```

OVP[,<U_{ovp}>] - Over Voltage Protection

This command adjusts the over voltage protection. Entering the command without parameter displays the present set point. If the set point is higher than a maximum of 1.2 x voltage of the unit, the range error bit within the ESR register of the interface is set. The present set point remains unchanged.

Example:

```
GTR             Remote operation mode
OVP,200         Over voltage protection 200 V
UA,100          Output voltage 100 V
IA,10           Output current 10 A
SB,R            Output open
```

PA[,<P_{LIMIT}>] - SET P_{LIMIT}

This command adjusts the power limitation for UIP mode. Entering the command without parameter displays the present set point. If the set point is higher than the maximum power of the unit, the range error bit within the ESR register of the interface is set. The present set point remains unchanged.

Example:

GTR	Remote operation mode
MODE,UIP	UIP mode activated
OVP,200	Over voltage protection 200 V
UA,100	Output voltage 100 V
IA,10	Output current 10 A
PA,500	Power limitation 500 W
SB,R	Output open

In master/slave mode the power of a programmed device is adjusted. Total output is n x PA.

Example:

2 devices are in M/S mode. The command PA,100 sets the power output to 100 W. Both connected device are adjusted to 100 W. The total output is 2 x 100 W = 200 W.

PCx[,<baud>,<parity>,<data bits>,<stop bits>,<handshake>,<echo>,<timeout>] - Program Communication

This command adjusts the interfaces. The LAB/HP has a maximum of 3 digital interfaces (x = 1, 2 or 3). The corresponding commands are ***PC1***, ***PC2*** or ***PC3***. Type and number of parameters depend on the type of interface. Currently there are no settings available for GPIB and LAN. Entering the command without parameter displays present interface parameters.

Parameter	Function
<baud>	Baud rate in bps
<parity>	Data parity O = Odd = Uneven parity E = Even = Even parity N = None = No parity bit
<data bits>	Number of data bits
<stop bits>	Number of stop bits
<handshake>	Handshake H = Hardware S = Software N = None (no handshake)
<echo>	Character echo E = Echo = echo on N = None = echo off
<timeout>	Timeout in ms when switching between sending and receiving (RS485 only)

Allowed parameters for RS232 interface:
PCx,<baud>,<parity>,<data bits>,<stop bits>,<handshake>,<echo>

Parameter	Function
Baud:	1200, 2400, 4800, 9600, 14400, 19200, 38400, 57600, 62500, 115200
Parity:	O, E, N
Data bits:	7, 8
Stop bits	1, 2
Handshake:	H, S, N
Echo:	E, N

Allowed parameters for USB interface:
PCx,<baud>,<parity>,<data bits>,<stop bits>,<handshake>,<echo>

Parameter	Function
Baud:	1200, 2400, 4800, 9600, 14400, 19200, 38400, 57600, 62500, 115200
Parity:	O, E, N
Data bits:	7, 8
Stop bits	1, 2
Handshake:	H, S, N
Echo:	E, N

Note: The USB interface of the PC is controlled like a virtual COM port and therefore the parameters correspond to those of the RS232 interface.

Allowed parameters for RS485 interface:
PCx,<baud>,<parity>,<data bits>,<stop bits>,<timeout>

Parameter	Function
Baud:	1200, 2400, 4800, 9600, 14400, 19200, 38400, 57600, 62500, 115200
Parity:	O, E, N
Data bits:	7, 8
Stop bits	1, 2
Timeout:	0…100

If the interface parameters must be changed permanently, the data must be saved after the ***PCx*** command with the command ***<SS>***. No return value.

Example:

PC1	Query of first interface parameters
PC1,RS232,9600,N,8,2,N,E	Unit answers: PC1 is a RS232 interface, 9600 bauds, 8 data bits, 2 stop bits, no handshake, no parity, echo on.
PC1,115200,N,8,2,N,E	Adjust baud rate to 115200 baud. The new baud rate is active immediately after the command has been sent!
PC2	Query of second interface parameters
PC2,RS485,9600,N,8,1,1	Unit answers: PC2 is a RS485 interface, 9600 bauds, 8 data bits, 1 stop bit. Timeout when switching between receiving and sending is 1 ms.
PC2,9600,N,8,1,50	Increase timeout to 50ms.
PC3	Query of third interface parameters
PC3, EMPTY	Unit answers: Interface 3 is not available in this unit.
SS	Save settings.

RA[,<R_i>] - Set R_i

This command adjusts the internal resistance for UIR mode. Entering the command without parameters displays the present set point. If the set point is out of adjustment range the range error bit of the interface is set in the ESR register. The present set point remains unchanged. Adjustment range can be requested with the commands ***LIMRMAX*** and ***LIMRMIN***.

Example:

GTR	Remote operation mode
MODE,UIR	UIR mode activated
OVP,200	Over voltage protection 200 V
UA,100	Output voltage 100 V
IA,10	Output current 10 A
RA,0.1	Internal resistance 0,1 Ohm
SB,R	Output open

REGLER[,<Nr>,<Kp>,<Ki>,<Kd>] – Controller Parameter

Settings for controller parameters in UIP, UIR and PV_{sim} mode. Entering the command without parameters displays the present settings as a table. The number of the parameter determines the parameter set which is to be adjusted.

0 Controller for UIP
1 Controller for UIR
2 Controller for PV_{sim}

The range of values for controller parameters is 0 - 30000. New settings can permanently be saved with the command ***SS***. For a detailed description of the controller parameters see →*Controller*.

Example:

REGLER	Read present settings
Type P I D	Unit answers:
P 10 20 5	UIP Mode Kp = 20 Ki = 10 Kd = 5
Ri 20 20 2	UIR Mode Kp = 20 Ki = 20 Kd = 5
Pv 10 5 5	PV Mode Kp = 10 Ki = 5 Kd = 5
REGLER,0,10,10,5	New controller parameters for UIP mode
REGLER,1,22,18,5	New controller parameters for UIR mode
SS	Save new settings

RI OR *RST - RESET INSTRUMENT

The unit executes a hardware reset. No return value.

SB[,{S|R|1|0}] - STANDBY

This command enables/disables the output. Entering the command without parameters displays the present standby status. The commands ***SB,S*** and ***SB,1*** switch the unit to standby mode, the output is disabled. The commands ***SB,R*** and ***SB,0*** disable the standby mode, the output is enabled.

Example:

GTR	Remote operation mode
OVP,200	Over voltage protection 200 V
UA,100	Output voltage 100 V
IA,10	Output current 10 A
SB,R	Output is active
SB	Retrieve standby status
SB,R	Unit answers: output is active

SCR[,<CMD>[,<VALUE>]] - LOAD SCRIPT

With this command the script memory can be programmed. The command ***SCR*** without parameters initializes the programming procedure. The command ***SCR*** with parameters writes the commands into the script memory. The order of the commands corresponds to the order of commands of the script. Script commands and their parameters are described in the chapter → *Script Control*.

Example:

GTR	Remote operation mode
OVP,200	Over voltage protection 200 V
SCR	Initialisation of script programming
SCR,U,12	1. script command: U = 12 V
SCR,I,15	2. script command: I = 15 A
SCR,UI	3. script command: mode UI
SCR,RUN	4. script command: activate output
SCR,LOOPCNT,10	5. start address loop
SCR,U,12	6. script command: U = 12 V
SCR,DELAY,8	7. script command: wait 8 ms
SCR,U,1	8. script command: U = 1 V
SCR,DELAY,1000	9. script command: wait 1 s
MODE,SKRIPT	Activate script mode
SB,R	Start script

SS OR *PDU - SAVE SETUP

Saves present unit parameters (interface parameter and controller parameter). No return value.

STATUS

Query of device status. Return value in binary units. Function of the bits within the status byte:

Bit	Function
D15	Number of units in M/S mode. If no other device is connected, 1 is displayed, if two devices are connected to the bus, 2 is displayed etc. If M/S mode was disabled via configuration menu, 0 is displayed.
D14	
D13	
D12	
D11	- reserved -
D10	- reserved -
D9	- reserved -
D8	Limit mode, unit in power limitation mode
D7	Limit mode, unit in current limitation mode
D6	Local lockout (1 = LLO active, 0 = LLO not active)
D5	Local (1 = front panel operation)
D4	Remote (1 = digital interface operation)
D3	- reserved -
D2	- reserved -
D1	Standby (1 = unit in standby mode)
D0	OVP (1 = shut down by over voltage protection)

Example:

STATUS	Status query
STATUS,0000000100010000	Unit answers: Remote operation mode, power limitation

UA[,<U_{MAX}>] - SET U_{MAX}

This command adjusts the voltage limitation. Entering the command without parameters displays the present set point. If the set point exceeds the maximum voltage of the unit, the range error bit within the ESR register of the interface is set. The present set point remains unchanged. If the set point is higher than the selected value for U_{limit}, but lower than the unit's maximum voltage, voltage limitation is restricted to U_{limit}. There is no error message.

Example:

GTR	Remote control operation
OVP,320	Over voltage protection 320 V
UA,100	Output voltage 100 V
IA,10	Output current 10 A
SB,R	Output is active
UA,400	Output voltage 400 V. This command is ignored because the voltage is higher than the maximum voltage of the unit. Range error is set within the status byte.
UA,250	Output voltage 250 V. Since the output voltage was limited to 200 V via configuration menu, voltage limitation is adjusted to 200 V. An error bit is not set.
UA	Query of adjusted voltage
UA,200.0V	Unit answers: set point U_a = 200 V

In master/slave mode the voltage of the programmed device is set. In master/slave serial connection the total voltage is n x UA.

Example:

3 devices are connected in series while in M/S mode. With UA,10 an output voltage of 10V is programmed. Therefore all connected devices are adjusted to 10V. Since three devices are connected in series, the total voltage is 3 x 10 V = 30 V.

UMPP[,<UMPP>] - SET U_{MPP}

This command adjusts the MPP voltage for PV_{sim} mode. Entering the command without parameters displays the present set point. If the set point is higher than the maximum voltage of the unit, the range error bit within the ESR register of the interface is set. The present set point remains unchanged. If the set point is higher than the U_{limit} value which was adjusted in the configuration menu, but lower than the maximum voltage of the unit, the voltage limitation is restricted to U_{limit}. There is no error message.

Example:

GTR	Remote operation mode
OVP,200	Over voltage protection 200 V
UA,50.5	Open circuit voltage of a simulated PV generator 50.5 V
IA,10	Short-circuit current of a simulated PV generator 10 A
UMPP,40.4	MPP voltage of a simulated PV generator 40.4 V
IMPP,8.2	MPP current of a simulated PV generator 8.2 A
MODE,PVSIM	Activate PV_{sim} mode
SB,R	Output active

In master/slave mode the MPP voltage of the programmed device is adjusted. When connected in series, the MPP total voltage is n x UMPP.

WAVE - END USERWAVE DATA

This command ends the transfer of a user defined output characteristic. Interpolation of interim values is layered. For detailed information about the function of this command see → *Wavereset*.

WAVELIN - END USERWAVE DATA

This command ends the transfer of a user defined output characteristic. Interpolation of interim values is linear. For detailed information about the function of this command see → *Wavereset*.

WAVERESET,<U_{MAX}><I_{MAX}> - START USERWAVE DATA

Starts the transfer of a user defined output characteristic. The parameters U_{max} and I_{max} define the maximum voltage of the output characteristic. Afterwards, the fulcrums of the UI characteristic can be entered using the command ***DAT***. The characteristic ends with the commands ***WAVE*** or ***WAVELIN***.

Example:

GTR	Remote operation mode
OVP,200	Over voltage protection 200 V
WAVERESET,100,10	Output characteristic with a maximum of 100 V and 10 A
DAT,90,1	Fulcrum 90 V, 1 A
DAT,50,5	Fulcrum 50 V, 5 A
DAT,10,9	Fulcrum 10 V, 9 A
WAVELIN	End of characteristic, linear interpolation
MODE,USER	Activates the created UI characteristic
SB,R	Output active

For more information and examples of user defined characteristics see → *Wave, Wavelin* and *Programming of characteristics (Script Operation)*.

RESPONSE STRING

The response string has the following format:

command comma value unit <CR> <LF>

The value is a floating point string with a '**.**' as delimiter.

Command	Response
IA	IA,12.34A
LIMU	LIMU,500.0V
LIMI	LIMI,30.00A
LIMP	LIMP,15000W
LIMRMIN	LIMRMIN,0.015R
LIMRMAX	LIMRMAX,0.110R
LIMR	LIMR,0.015R,0.110R

Command	Response
MU	MU,10.0V
PA	PA,12W
RA	RA,0.015R
UA	UA,100.0V
UMPP	UMPP,90.2V
IMPP	IMPP,10.01A
OVP	OVP,600.0V

Example: Command as ASCII and HEX protocol

L	I	M	U	,	5	0	0	.	0	V		
4C	49	4D	55	2C	35	30	30	2E	30	56	0D	0A

The digits after the decimal point correspond to the resolution of the unit.

Example

UA at a 600 V unit UA,123.4V
UA at a 50 V unit UA,23.44V

The digits before the decimal point depend on the present measurement value.

Example: 600 V unit

UA,10.4V
UA,220.3V
UA,1.1V

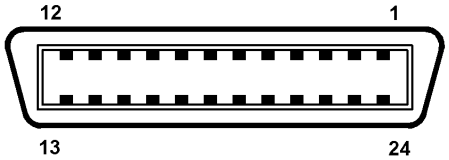
Example: 50 V unit

UA,1.23V
UA,10.47V
UA,0.01V

EXT. CONTROL: COMPUTER

GPIB

Connection is carried out with a 24pin Centronics connector. The device address is adjusted with the DIP switches S1-S5. Here, S1 has the lowest priority and S5 the highest.



No	Name	Function
1	DIO1	Data line 1
2	DIO2	Data line 2
3	DIO3	Data line 3
4	DIO4	Data line 4
5	EOI	End or Identify
6	DAV	Data Valid
7	NRFD	Not Ready For Data
8	NDAC	No Data Accepted
9	IFC	Interface Clear
10	SRQ	Service Request
11	ATN	Attention
12	SHIELD	Shield
13	DIO5	Data line 5
14	DIO6	Data line 6
15	DIO7	Data line 7
16	REN	Remote Enable
18 - 23	GND	Ground
24	SGND	Signal Ground

Table: Device address

S1	S2	S3	S4	S5	Address
Off	Off	Off	Off	Off	0
On	Off	Off	Off	Off	1
Off	On	Off	Off	Off	2
On	On	Off	Off	Off	3
Off	Off	On	Off	Off	4
On	Off	On	Off	Off	5
Off	On	On	Off	Off	6
On	On	On	Off	Off	7
Off	Off	Off	On	Off	8
On	Off	Off	On	Off	9
Off	On	Off	On	Off	10
On	On	Off	On	Off	11
Off	Off	On	On	Off	12
On	Off	On	On	Off	13
Off	On	On	On	Off	14
On	On	On	On	Off	15

S1	S2	S3	S4	S5	Address
Off	Off	Off	Off	On	16
On	Off	Off	Off	On	17
Off	On	Off	Off	On	18
On	On	Off	Off	On	19
Off	Off	On	Off	On	20
On	Off	On	Off	On	21
Off	On	On	Off	On	22
On	On	On	Off	On	23
Off	Off	Off	On	On	24
On	Off	Off	On	On	25
Off	On	Off	On	On	26
On	On	Off	On	On	27
Off	Off	On	On	On	28
On	Off	On	On	On	29
Off	On	On	On	On	30
On	On	On	On	On	31

The device address is read in only when the unit is switched on. Changing the DIP switches while the unit is active will not change the device address!

Table: Device equipment (according to IEEE-488.1)

SH1	Source Handshake function available
AH1	Acceptor Handshake function available
T6	Talker, Serial Poll, end addressing by MLA
L4	Listener function, end addressing by MTA
SR1	Service request available
RL1	Remote/Local function available
PP0	No parallel poll function
DC1	Device clear function available
DT0	No trigger function
C0	no controller function
E1	Open-collector driver

STATUS WORD

The status word can be read with the command ***<STB>*** or ***<*STB?>***. Return value: STB,xxxxxxxx

Table: Reading the status word

Bit	Function
D7	n/a
D6	SRQ is set, if SRQ was requested
D5	ESB is set, if a byte was set within the SES register
D4	MAV is set, if a message is available
D3	n/a
D2	see table
D1	see table
D0	see table

Table: Error messages

D3	D2	D1	D0	Error
0	0	0	1	Syntax
0	0	1	0	Command
0	0	1	1	Range
0	1	0	0	Unit
0	1	0	1	Hardware
0	1	1	0	Read

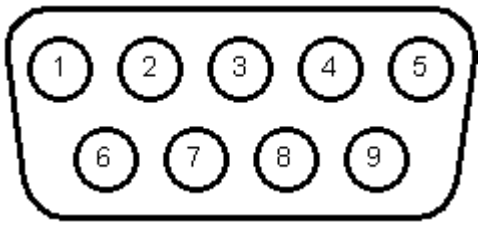
ESR-REGISTER - EVENT-STATUS-REGISTER

The ESR register can be read using the command ***<*ESR?>***. Return value: ESR,xxxxxxxx. After the query, the ESR register is deleted.

Bit	Function
D7	Power on
D6	Command error
D5	User request
D4	Execution error
D3	Device dependent error
D2	Query error
D1	Request control
D0	Operation complete

RS232 INTERFACE

The connection of the RS232 interface is carried out with a 9pin sub D connector. A null modem cable must be used as connector cable.



No	Name	Function
1	N.C.	
2	TxD	Data line from unit to PC
3	RxD	Data line from PC to unit
4	N.C.	
5	GND	GND
6	N.C.	
7	CTS	Reception of the PC, signal direction from PC to unit (only required for active Hardware handshake)
8	RTS	Reception of the unit, signal direction from unit to PC (only required for active Hardware handshake)
9	N.C.	

The interface can be operated using the following parameters:

Baud rate:	1200, 2400, 4800, 9600, 14400, 19200, 38400, 57600, 62500, 115200
Parity:	O = Odd = uneven parity E = Even = even parity N = None = no parity bit
Number of data bits:	7 or 8
Number of stop bits:	1 or 2
Handshake:	H = Hardware S = Software N = None (no handshake) The defined character for XON is 0 x 11 and for XOFF it is 0 x 13.

Interface parameters in delivery state are 9600 baud, no parity, 8 data bits, 1 stop bit, echo on. The status word can be read with the command ***<STB>*** or ***<*STB?>***. The following functions are assigned to the bits:

Bit	Function
D15	Parity error
D14	Over run error
D13	Framing error
D12	Timeout error
D11	Echo on
D10	used internally, can be 1 or 0
D9	Hardware handshake (RTS/CTS)
D8	Software handshake (XON/XOFF)
D7	Parity enable
D6	Parity mode (1 = odd, 0 = even)
D5	Stop bit (1 = 2 stop bits; 0 = 1 stop bit)
D4	Data format (1 = 8 bit; 0 = 7 bit)
D3	used internally, can be 1 or 0
D2	→ Table
D1	→ Table
D0	→ Table

Table: Error messages

D2	D1	D0	Error
0	0	1	Syntax
0	1	0	Command
0	1	1	Range
1	0	0	Unit
1	0	1	Hardware
1	1	0	Read

If echo is on, the interface confirms each incoming character by sending the same character back to the sender. The interface parameters can be adjusted via software and the command ***<PCx>***. These settings can be saved with the command ***<SS>***.

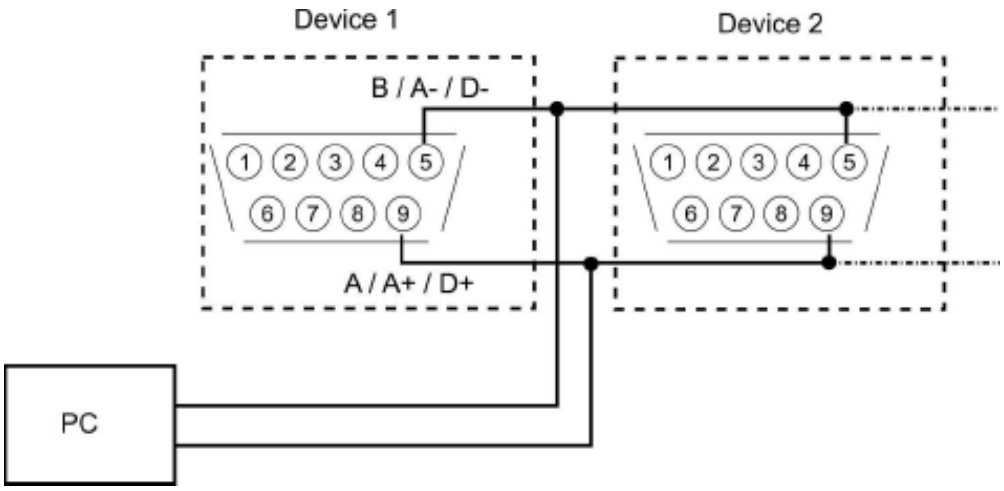
INTERFACE RECONFIGURATION

In case, the user has forgotten the active setup, there are two ways of reconfiguring the interface:

- sending the command ***<PCx>*** from one of the other interfaces
- using the display to configure the interface → *Interface Parameters*

RS485 INTERFACE

The connection of the RS485 interface is carried out with a 9pin sub D connector.



The interface works with the following parameters:

Baud rate:	1200, 2400, 4800, 9600, 14400, 19200, 38400, 57600, 62500, 115200
Parity:	O = Odd = uneven parity
	E = Even = even parity
	N = None = no parity bit
Number of data bits:	7 or 8
Number of stop bits:	1 or 2
Timeout:	0-100 ms

A timeout is the time between receipt and sending of a message. The connected device is selected by entering the command and placing the number of the device and '#' before it. When using the word ‚ALL' instead of a number, the following command will be executed by all connected devices (e. g. *#1,ID; #22,GTR, #ALL,GTL*).

Example:

```
#1,ID
#22,GTR
#ALL,GTL
```

The status word can be read with the command ***<STB>*** or ***<*STB?>***. The following functions are assigned to the bits:

Bit	Function
D15	Parity error
D14	Over run error
D13	Framing error
D12	Timeout error
D11	n/a
D10	n/a
D9	n/a
D8	n/a
D7	Parity enable
D6	Parity mode (1 = odd, 0 = even)
D5	Stop bit (1 = 2 Stop bits; 0 = 1 Stop bit)
D4	Data format (1 = 8 bit; 0 = 7 bit)
D3	n/a
D2	→ Table
D1	→ Table
D0	→ Table

Table: Error messages

D2	D1	D0	Error
0	0	1	Syntax
0	1	0	Command
0	1	1	Range
1	0	0	Unit
1	0	1	Hardware
1	1	0	Read

Interface parameters are configured via software using the command ***<PCx>***. The settings can be saved with the command ***<SS>***.

INTERFACE RECONFIGURATION

In case, the user has forgotten the active setup, there are two ways of reconfiguring the interface:

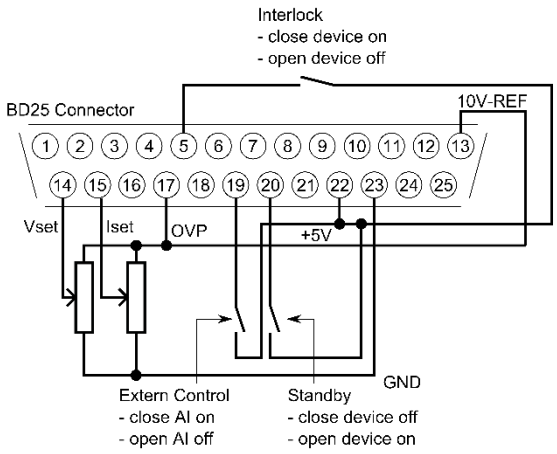
- sending the command ***<PCx>*** from one of the other interfaces
- using the display to configure the interface → *Interface Parameters*

EXT. CONTROL: AI INTERFACE (OPTION)

The device can be controlled via control signals and by using the analog/digital In/Out

PIN ASSIGNMENT AI INTERFACE

No (BD25)	Dir	Name	Function
1	analog out	U_{mon}	Monitor set point U
2	analog out	I_{mon}	Monitor set point I
3	analog out	P_{mon}	Monitor actual value P
4	analog out	OVP_{mon}	Monitor actual value OVP
5	digital in	Soft-Interlock	Interlock function (Caution: Interlock does not correspond to the machinery directives)
6	-nc-	-	-
7	digital out	CV	Signals „Const. Voltage“ mode
8	analog out	U_{istmon}	Monitor output voltage
9	gnd	GND	-
10	digital out	Standby	Signals standby
11	gnd	GND	-
12	-nc-	-	-
13	REF10	10 V-V_{ref}	Output 10 V reference voltage
14	analog in	U_{set}	Set point U
15	analog in	I_{set}	Set point I
16	analog in	In 2	-
17	analog in	OVP_{set}	Set point OVP
18	analog in	In 4	-
19	digital in	Ext. Control	Activates analog control
20	digital in	Standby	Activates standby
21	analog out	I_{istmon}	Monitor output current
22	pwr	+ 5 V	Output 5 V supply voltage
23	gnd	GND	-
24	digital out	Error	Signals shut down by OVP
25	gnd	GND	-
26	-nc-	-	-



All digital outputs are OC outputs with a pull-up resistance after + 5 V. All analog inputs and outputs can be operated in 0-5 V or in 0-10 V mode.

ANALOG INPUT

Set points are adjusted as dc voltage (0-5 V or 0-10 V) on the analog inputs. The voltage range can be chosen in the configuration menu. To save all changes after changing the voltage range, the unit must be restarted.

SET POINT U (U_{SET})

Set point output voltage. The set point refers to the rated voltage of the unit.

Example:

LAB/HP at 600 V output voltage, AI is adjusted to 10 V, desired output voltage = 100 V.
U_{set} = 10 V * 100 V ÷ 600 V = 1,667 V

SET POINT I (I_{SET})

Set point output current. The set point refers to the rated current of the unit.

Example:

LAB/HP at 100 A output voltage, AI is adjusted to 10 V, desired output current = 2 A.
I_{set} = 10 V * 2 A ÷ 100 A = 0.200 V

SET POINT OVP (U_{OVP})

The output is deactivated immediately if the output voltage exceeds the adjusted value. This error is indicated on the display with the word „Error“. To reset this error, standby mode must be activated. Adjustment range is 0 V up to the maximum rated voltage of the device + 20%.

Example:

LAB/HP with 600 V output voltage, AI is adjusted to 10 V, desired OVP voltage = 650 V.
Adjustment range: 600 V + 20% = 720 V
U_{set} = 10 V * 650 V ÷ 720 V = 9.028 V

ANALOG OUTPUT

On the analog outputs, present measurement values are displayed as dc voltage values (regardless of the actual operation mode). Therefore the AI interface can be used for monitor purposes. Maximum voltage is 5 V / 10 V.

MONITOR SET POINT U (U_{MON})

Present set point of the output voltage. Measurement value refers to the rated voltage of the device.

Example:

LAB/HP at 600 V output voltage, AI is adjusted to 10 V, voltage at output U_{mon} = 2 V.
Present set point: U_{set} = 2 V * 600 V ÷ 10 V = 120 V

MONITOR SET POINT I (I_{MON})

Present set point of the output current. Measurement value refers to the rated current of the device.

Example:

LAB/HP at 100 A output current, AI adjusted to 10 V, voltage at output I_{mon} = 2 V.
Present set point: I_{set} = 2 V * 100 V ÷ 10 V = 20 A

MONITOR ACTUAL VALUE P (P_{MON})

Present set point for output power. It is calculated by the controller from measurement values of output voltage and output current. Measure value refers to the rated power of the device.

Example:

LAB/HP at 15 kW rated power, AI adjusted to 10 V, voltage at output P_{mon} = 5 V.
Present output power P_{out} = 5 V * 15 kW ÷ 10 V = 7.5 kW

ANALOG OUTPUT OVP (U_{OVPMON})

Present set point for over voltage protection. Measurement value refers to the rated voltage of the device + 20%.

Example:

LAB/HP at 600 V output voltage, AI adjusted to 10 V, voltage at output U_{mon} = 2 V. Signal refers to 600 V + 20% = 720 V.
Present set point: U_{ovp} = 2 V * 720 V ÷ 10 V = 144 V

MONITOR OUTPUT VOLTAGE (U_{ISTMON})

Present measure value point value for output voltage. Measurement value refers to the rated voltage of the device.

Example:

LAB/HP at 600 V output voltage, AI adjusted to 10 V, voltage at output U_{istmon} = 6 V.
Present output voltage U_{out} = 6 V * 600 V ÷ 10 V = 360 V

MONITOR OUTPUT CURRENT (I_{ISTMON})

Present measure value for output current. Measurement value refers to the rated current of the device.

Example:

LAB/HP at 100 A output current, AI adjusted to 10 V, voltage at output I_{istmon} = 4 V.
Present output current I_{out} = 4 V * 100 A ÷ 10 V = 40 A

DIGITAL INPUT

The digital inputs can be used to adjust the operation mode for the analog control. Inputs are low active.

ACTIVATION (EXT. CONTROL)

The input ‚Ext. Control' can be used to chose the operation mode ‚*AI*'. The AI interface is activated by an applied voltage of + 5 V up to + 10 V. Front panel operation is deactivated. Operation mode is marked as ‚*AI*' on the display. The digital interface takes priority over the AI interface. The settings from AI interface have no effect if the device is toggled to ‚*Remote*'.

SOFT-INTERLOCK

The Interlock deactivates the unit immediately, when the connection between interlock input (Pin 5) and +5 V voltage is opened. In this case, the output of the unit cannot be activated, neither by interface nor by front panel. The difference between Soft-Interlock and Interlock is that a Soft-Interlock does not correspond to the machinery directives. If the Soft-Interlock is triggered, the unit switches into Interlock-Mode.

Effect of an interlock on the status byte is configurable:

- SS,ILSTBON -> Standby is set in the case of an interlock.
- SS,ILSTBOFF -> In case of an interlock, standby remains unchanged.

BLOCKING (STANDBY)

The standby mode is activated by an applied voltage of + 5 V up to + 10 V.
The output signal is enabled, if the input ‚*Standby*' is toggled inactive.

DIGITAL OUTPUT

On the digital outputs, actual device adjustments are displayed (irrespective of the actual operation mode). Therefore the AI interface may be used for monitoring functions also. Gauges are consistent with a negative logic: S = Set = log. 0; R = Reset = log. 1

A set output has a voltage level of < 0.6 V. A reset output has a voltage level of > 1.2 V.

BLOCKING (STANDBY)

The blocking of the output is set, if the unit is in standby mode.

CONST. VOLTAGE MODE (CV)

Constant voltage mode is set, when the unit is in constant voltage mode.

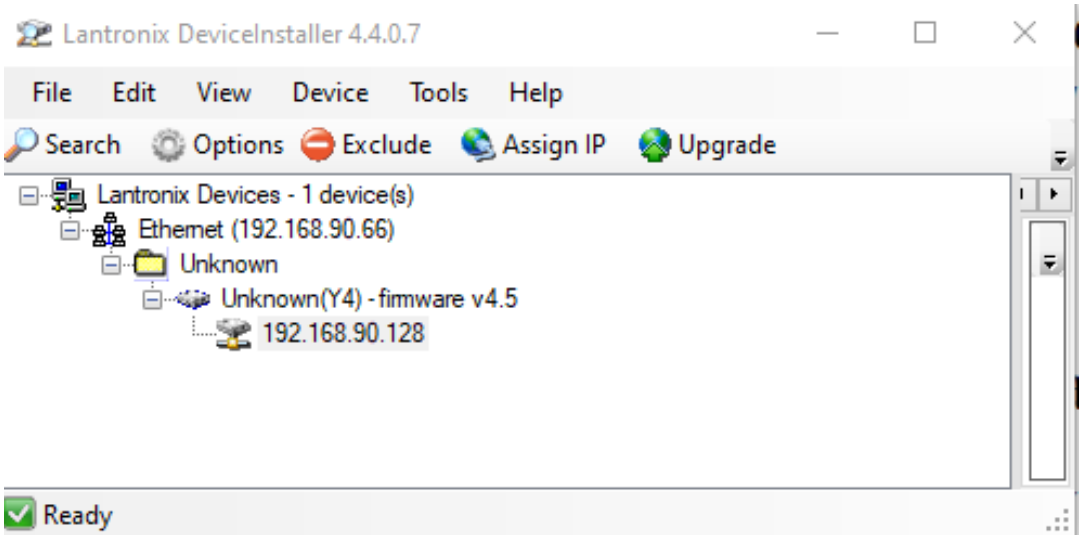
ERROR

An error is set, if the unit has been shut down by OVP. To reset this error, the standby mode must be activated.

EXT. CONTROL: ETHERNET (LAN)

To communicate with the LAB/HP via network, it is necessary to find the IP device first. In delivery status, the device automatically draws an IP from the network. In its practical operation, this behavior is unfavorable, because after each activation the device has a new IP address. Therefore, to each device an individual, permanent IP address should be assigned.

The easiest way to check the IP of the device is by starting Lantronix device installer software. Click “search”. Now your network gets scanned for devices. You can see the device and its IP address.



You can also find the IP by typing “arp -a” in the command prompt in windows. Check the MAC address of the device (label on the device or in calibration protocol). The IP on the left side of the MAC address is the current IP of the device.

```
192.168.90.128          00-80-a3-e8-98-5b     dynamisch
```

The status word can be read with the command ***<STB>*** or ***<*STB?>***. Only bits from D0 up to D2 are in use. All other bits can be 1 or 0.

Table: Error messages

D2	D1	D0	Error
0	0	1	Syntax
0	1	0	Command
0	1	1	Range
1	0	0	Unit
1	0	1	Hardware
1	1	0	Read

MANUAL ASSIGNMENT OF AN IP VIA WEB INTERFACE

You can enter the web page by typing the IP in your browser http://xxx.xxx.xxx.xxx

Username: admin
Password: PASSWORD

To set a static IP for the device you have to click “Webconfig”. There you can set the new IP of the device. (Uncheck dynamic IP).

MONITORING THE DEVICE VIA BROWSER

The user interface opens via direct request of the IP address: http://xxx.xxx.xxx.xxx.

Username: admin
Password: PASSWORD

The item menu ‚Display‘ opens the Monitoring section of the unit. Displayed are all present measurement values, which are updated every 2 seconds.

U	100.0	V
I	1.00	A
P	100	W
R	100	Ohm

Status

Mode	UI
Status	Run
Control	Remote
Limit	U

When controlling the device via browser, another control via telnet must not be active!

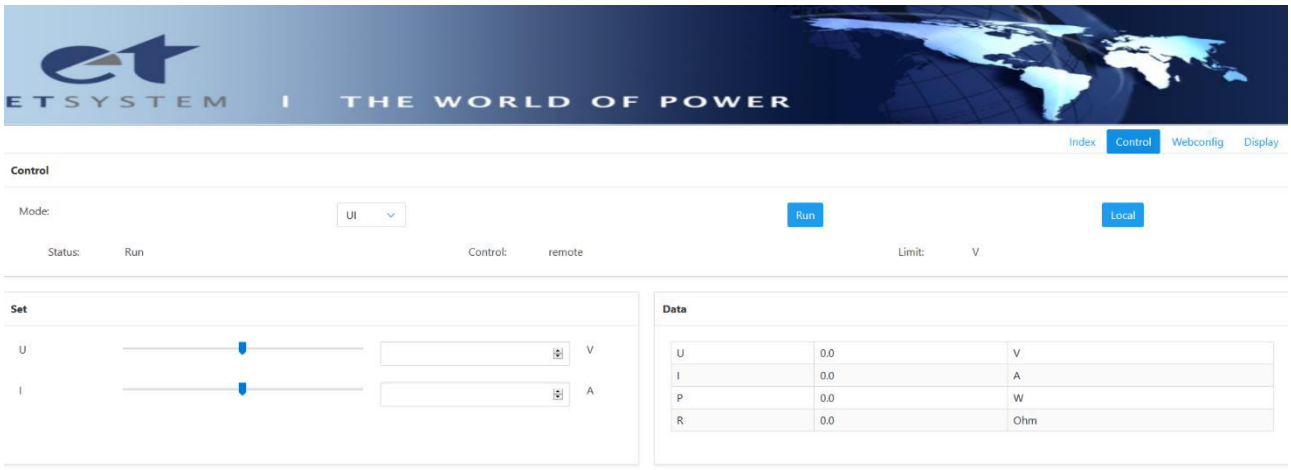
CONTROLLING THE DEVICE VIA TELNET

The device can be controlled directly via port 10001. After the console has been opened, a click on ‚Start' and ‚Ausführen' opens an input field. After the commands ***cmd*** or ***command*** have been entered, a DOS window opens with: telnet xxx.xxx.xxx.xxx 10001.
Alternatively, many terminal programs offer the possibility to establish a TCP/IP or telnet connection.

When controlling the device via port 10001, the user interface of the device must not be open in a browser!

CONTROLLING THE DEVICE VIA BROWSER

The user interface can be opened via IP address: http://xxx.xxx.xxx.xxx. The menu ‚*Control*' opens the controlling section of the unit. Here you can set all parameters which you can also set directly on the display.


ETSYSTEM
THE WORLD OF POWER
Index
Control
Webconfig
Display
Control
Mode:
UI
Run
Local
Status:
Run
Control:
remote
Limit:
V
Set
U
V
I
A
Data
U 0.0 V
I 0.0 A
P 0.0 W
R 0.0 Ohm

EXT. CONTROL: USB

The USB interface provides a virtual COM port for the PC. Via this port, the unit can be controlled as with a normal RS232 interface, e. g. with a terminal program. Corresponding drivers for all current operating systems are available as download: http://www.ftdichip.com/Drivers/VCP.htm.

The status word can be read with the command ***<STB>*** or ***<*STB?>***.

Bit	Function
D15	Parity error
D14	Over run error
D13	Framing error
D12	Timeout error
D11	Echo on
D10	used internally, can be 1 or 0
D9	Hardware handshake (RTS/CTS)
D8	Software handshake (XON/XOFF)
D7	Parity enable
D6	Parity mode (1 = odd, 0 = even)
D5	Stop bit (1 = 2 Stop bits; 0 = 1 Stop bit)
D4	Data format (1 = 8 bit; 0 = 7 bit)
D3	used internally, can be 1 or 0
D2	→ Table
D1	→ Table
D0	→ Table

Table: Error messages

D2	D1	D0	Error
0	0	1	Syntax
0	1	0	Command
0	1	1	Range
1	0	0	Unit
1	0	1	Hardware
1	1	0	Read

The defined character for XON is 0 x 11 and for XOFF it is 0 x 13.

Interface parameters are adjusted by software with the command ***<PCx>*** and afterwards they can be saved with the command ***<SS>***.

INTERFACE RECONFIGURATION

In case, the user has forgotten the active setup, there are two ways of reconfiguring the interface:

- sending the command ***<PCx>*** from one of the other interfaces
- using the display to configure the interface → *Interface Parameters*

DATA LOG FUNCTION (OPTION)

The device has a data log function. A memory card may be used as data logger. All measurement values will be saved, separated by tabulators, in a text file. The time interval may be adjusted from 1-4294967s (= 71 minutes). To activate the data log function, a memory card must be inserted. The root directory of the memory card must contain a text file named “LABLOG.txt“. The new data will be written into this file.

The memory card must be inserted or removed in standby mode only!

In case, that the first entry of the first line of the file is "interval=xxxx" (xxxx = time in seconds), the memory interval is adjusted accordingly. The entry must be written in lower case letters and without space characters. If the interval remains unspecified, the memory interval is 60 seconds.

Example:

interval=30

The data log function is active whenever the device is not operating in standby mode. The function is indicated by a small memory card symbol in the upper right corner of the main display. Whenever a new data set is written, the symbol will be displayed as filled for ca. 1 second. In case the memory card is full, the symbol will be crossed out.

FORMAT OF THE SAVED DATA

The first entry shows the present operation mode. The second entry shows the present operation mode followed by ‚U_{dc}' and ‚I_{dc}'.

Example:

USER	I-Limit 1,0	10,02
USER	OVP 0,0	0,00
UI	U-Limit 100,01	0,10
UIP	U-Limit 100,0	0,10

SCRIPT MODE

Operation sequences may be programmed in a script which can be read in from a memory card. A script is a text file, which includes a sequence of commands. Alternatively, the script memory can be programmed via digital interface using the command ***SCR***. For more information about the use of this command see → *Commands*. The device is able to process up to 1000 commands.

EXECUTING/LOADING A SCRIPT

The script must be saved on a MMC or SD card as text file with .txt or .scr ending.

The mode ‚Scr' must be selected from the main display. Pushing the rotary pulse encoder will open the file selection menu. The script file can be selected. An error message appears if, the file could not be read correctly or, if the read in setup is invalid (e. g. IA 40 at a 10 A unit). To return to the file selection menu, the rotary pulse encoder or the button ***Display*** must be pushed again. The script has been loaded and can be started by pushing the button ***Standby***.

The last five commands of the script are displayed in the field ‚*Preset*'. The actual command is placed on top. The script ends when button ***Standby*** is pushed and device is toggled to standby mode.

AUTOMATIC START OF A SCRIPT

A file with the name DEFAULT.SCR is automatically run after switching on. This file must be stored on the memory card in the root directory. After switching on, the unit reads the script, automatically switches to script mode and starts the script.

If the script contains a command that enables the output (RUN), the output carries voltage without the user intervening.

COMMANDS

Syntax

Upper and lower case are nonrelevant. Therefore, the following commands deliver the same results: *PMAX 100, Pmax 100, pMaX 100.* Delimiters must be placed between two commands or between command and parameter. Valid delimiters are: blank, tabulator, LineFeed <LF>, Carriage Return <CR> and equal sign (=).

Numerical values must be placed as basic units and may not be followed by characters. Valid delimiters for decimal places are: point and comma. No characters must be attached: U 12,345 U 10.00 U 12. The command UAC 12.114V is invalid, because it is followed by a character.

All commands may be written consecutively but must be separated by blanks: U 10 I 1 UIP LOOP RUN. Due to its unclear syntax, this style is not recommendable.

Quick view of commands

Command	Description	Result
; or #	comment	Entering commented text.
DELAY<t>, DELAYS<t>	delay	Delays execution of the script for duration of time t.
I<I in ampère>	output current	Set point output current.
IMPP<I in ampère>	MPP current	MPP current in ampère for PV simulation.
LOOP, LOOPCNT	Loop	Define return address.
PMAX	maximum output UIP mode	Maximum output for UIP mode.
PV	PVsim mode	Activate PVsim mode.
RI	internal resistance UIR mode	Set point internal resistance in ohm for UIR mode.
RUN	open output	Enable output.
STANDBY	close output	Disable output.
U	set point output voltage	Set point output voltage in V.
UI	UI mode	Activate UI mode.
UIP	UIP mode	Activate UIP mode.
UIR	UIR mode	Activate UIR mode.
UMPP	set point MPP voltage	Set point MPP voltage (for PV simulation)
USER	set points current and voltage	Generates set points for current and voltage using the internal table.
WAIT	wait	Waits for user action.
WAVE, WAVELIN	characteristic programming	Characteristic programming.

DETAILED DESCRIPTION OF COMMANDS

; or # - Comment

Comment on text. All characters from ; or # up to end of line will be ignored. This function is not available when programming via digital interface.

Example:

```
# This is a comment
UIP  # This command activates the UIP mode
; Comments can also start with a semicolon
```

DELAY, DELAYS - TIME DELAY

The commands ***DELAY*** and ***DELAYS*** delay the execution of the script. The following number defines the duration of the delay in ms (milliseconds). Maximum duration of delay is 65535ms.

Example:

```
UI              # UI mode
U 10            # Output voltage 10 V
I 1             # Output current 1 A
RUN             # Activate output
DELAY 200       # Wait 200 ms
U 100           # Adjust output voltage to 100 V
DELAYS 10       # Wait 10 seconds
STANDBY         # Deactivate output
```

I - Set point output current

This command adjusts the set point for the output current in ampere.

Example:

```
I 9.8       # Output current 9.8 A
```

IMPP - SET POINT MPP CURRENT

This command adjusts the set point for the MPP current for PV simulation in ampere.

Example:

```
IMPP 8.123      # MPP current 8.123 A
```

LOOP, LOOPCNT - RETURN LOOP

Usually the script ends with the last command. A return address can be defined with the command ***<LOOP>***. From this point on, the processing will continue after the last command of the script. To interrupt the program, button ***Standby*** must be pushed. The command ***<LOOPCNT>*** equals the command ***<LOOP>***. But here, the command defines the number of loops. The maximum number is 65535.

Example:

```
# This example activates the output for 10s, then deactivates it for 2s
# and starts from the beginning. This will continue until the user interrupts the
# process by pushing the button Standby.
UI              # UI mode
U 100           # Output voltage 100 V
I 10            # Output current 10 A
LOOP            # Start address
RUN             # Activate output
DELAYS 10       # Wait 10s
STANDBY         # Deactivate output
DELAYS 10       # Wait 2s

# This example works like the previous one.
# The cycle is executed only 10 times, and then the script ends.
UI              # UI mode
U 100           # Output voltage 100 V
I 10            # Output current 10 A
LOOPCNT 10      # Start address
RUN             # Activate output
DELAYS 10       # Wait 10s
STANDBY         # Deactivate output
DELAYS 10       # Wait 2s
```

PMAX - MAXIMUM OUTPUT IN UIP MODE

Maximum output for the UIP mode.

PV - PV_{SIM} MODE

Activates the PV_{sim} mode.

Example:

PVSIM #Activate PV simulation

RI - INTERNAL RESISTANCE UIR MODE

This command adjusts the set point for the internal resistance in UIR mode.

RUN - Activate output

The command ***RUN*** resets the standby mode and activates the output.

Example:

RUN # Activate output

STANDBY - Deactivate output

The command ***STANDBY*** deactivates the output and activates standby mode.

Example:

STANDBY # Deactivate output

U - Set point output voltage

Set point for output voltage in V.

Example:

U 100 # Output voltage 100 V

UI - UI-MODUS

This command activates the UI mode. Unit works current and voltage regulated.

Example:

UI # UI mode

UIP - UIP MODE

This command activates the UIP mode. Unit works current, voltage and power regulated.

UIR - UIR MODE

This command activates the UIR mode. Unit works current and voltage regulated. Additionally, an internal resistance is simulated.

UMPP - SET POINT UMPP VOLTAGE

Set point for MPP voltage for PV simulation in V.

Example:

```
UMPP 80.42      # MPP voltage 80.42 V
```

USER - Set points current and voltage

This command generates the set points for current and voltage by using the internal table. Thereby, different UI characteristics can be created. The tables can be created beforehand by using the command ***WAVE***.

WAIT - WAITING FOR USER ACTION

The program is stopped until the user pushes the button ***Standby***.

Example:

```
; Starter characteristic:
UI              ; UI mode
I 10            ; Current limitation 10 A
U 12            ; Output voltage 12 V (->100%)
RUN              ; Activate output
LOOP            ; Start address after end of the script
WAIT            ; Waits until rotary pulse encoder is pushed
U 10,5          ; 1. ramp
U 9             ; Command is processed within 1 ms. Therefore the
U 7,5           ; ramp has 5 interim values.
U 6
U 4,5
DELAY 15        ; 15 ms pause
U 4,8           ; 2. ramp
U 5,1           ; Command is processed within 1 ms. Therefore
U 5,4           ; the ramp has 5 interim values.
U 5,7
U 6
DELAY 2000      ; 2000 ms pause
U 6,6           ; 3. ramp
U 7,2           ;   Command is processed within 1 ms. Daher
U 7,8           ;   The ramp has 10 interim values.
U 8,4
U 9
U 9,6
U 10,2
U 10,8
U 11,4
U 12
```

WAVE, WAVELIN - CHARACTERISTIC PROGRAMMING

The command ***WAVE*** is used to start the characteristic programming. The command is followed by numerical values, which indicate the desired voltage and current. Finally, followed by the command with a prefixed '-' characteristic (***-WAVE***).

WAVE
<U1> <I1>
<U2> <I2>
<U3> <I3>
...
<Un> <In>
-WAVE

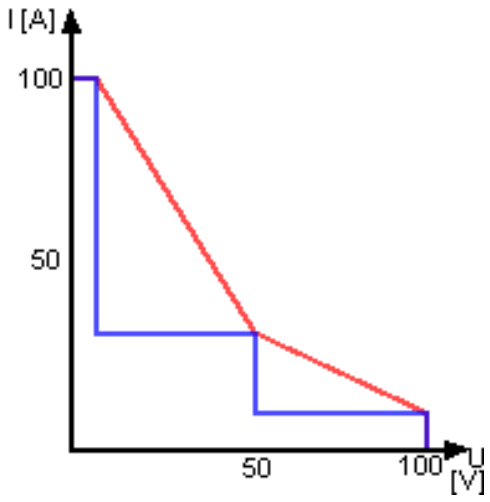
The command ***WAVELIN*** equals the command ***WAVE***.

WAVELIN
<U1> <I1>
<U2> <I2>
<U3> <I3>
...
<Un> <In>
-WAVELIN
WAVELIN

With the ***WAVELIN*** command, the interim values between the fulcrums are linear interpolated, with the ***WAVE*** command they are layered (see example). Characteristics which are not constant or negative in their course are accepted but the behavior of the unit may not be predicable.

Example:

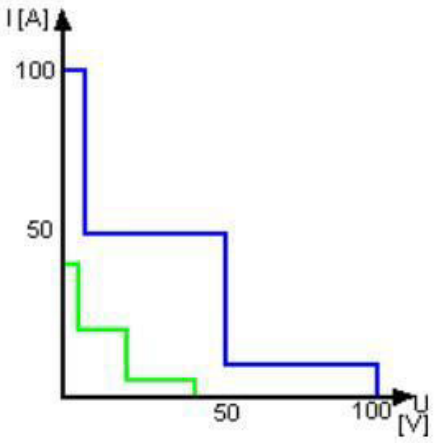
```
; Characteristic with layered interim values
; This script delivers the blue characteristic in the diagram
WAVE        ; Start of the table
100  10     ; 100 V 10 A
50    25    ; 50 V 25 A
10  100     ; 10 V 100 A
-WAVE       ; End of the table
RUN         ; Output active

; Characteristic with linear interim values
; This script delivers the red characteristic
WAVE        ; Start of the table
100  10     ; 100 V 10 A
50    25    ; 50 V 25 A
10  100     ; 10 V 100 A
-WAVELIN    ; End of the table
RUN         ; Output active
```



If output voltage or output current is changed afterwards, the characteristic keeps its course. Though values are stretched or compressed to the new range.

Example:

```
# This script generates a blue characteristic
# After a 10 second delay it switches to the green characteristic:
WAVE            # Start of the table
100 10          # 100 V   10 A
50 50           #  50 V   50 A
10 100          #  10 V 100 A
-WAVE           # End of the table
U 100           # Output Voltage 100 V
I 100           # Output Current 100 A
USER            # Select characteristic
RUN             # Output open
DELAY 10000     # Wait 10 seconds
U 50            # Output Voltage 50 V
I 50            # Output Current 50 A
```



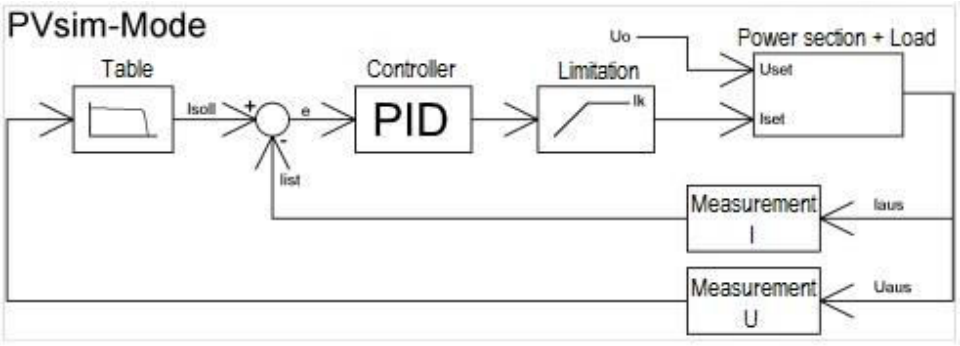
CONTROLLER

The software contains three digital PID controllers. Each controller is assigned to the UIR, UIP and PVsim mode. When required, the controller parameters can be changed via universal interface.

Improper adjustment of the controller can lead to controller oscillations which may damage connected devices!

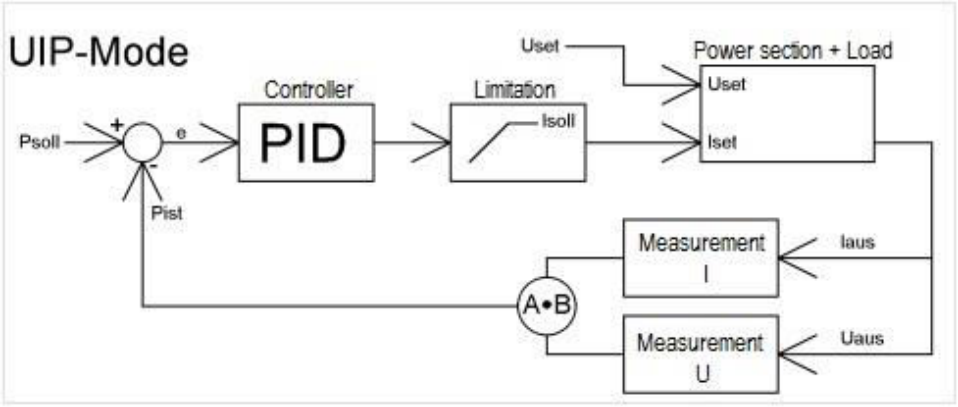
CONTROL STRUCTURE PVSIM MODE AND USER MODE

The current set point is calculated from the output voltage and a table. This set point stands for the input signal of the PID controller after it was subtracted from the actual value. The PID controller releases the current set point for the power supply. The current set point is limited to the short circuit current, as a maximum. The voltage set point of the power supply is permanently set to the open circuit voltage of the table. In PVsim mode the current is regulated while the voltage is fixed.



CONTROL STRUCTURE UIP MODE

The output voltage is multiplied with the output current. The result is subtracted from the power set point. This signal is the input signal of the PID controller, which releases the current set point for the power supply. The current set point is limited to the current set point, as a maximum. The voltage set point of the power supply is permanently set to the voltage set point. In UIP mode the current is regulated, while the voltage is fixed.

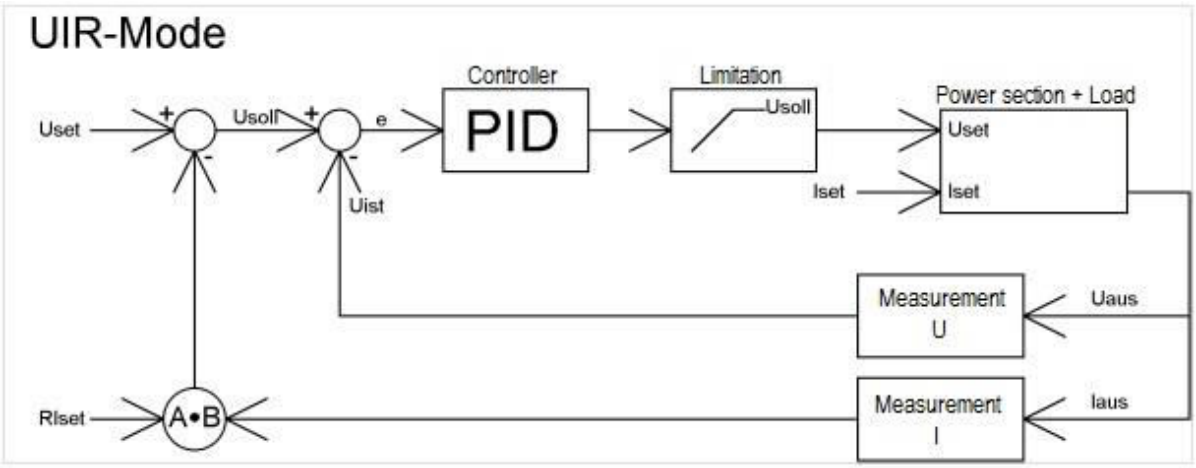


CONTROL STRUCTURE UIR MODE

The measured output current is multiplied with the adjusted internal resistance. The result is subtracted from the adjusted set point and is then the set point for the voltage controller:

$U_{soll} = U_{set} - I_a * R_i$

The output signal is limited to the voltage set point. The current set point of the power supply is permanently set to I_{soll}. In UIR mode the voltage is regulated while the current is fixed.



CONTROLLER PARAMETERS

common differential equation of a PID controller:

$$y = Kp \cdot \left(e + \frac{1}{Tn} \int e(t)dt + Tv \frac{de}{dt} \right)$$

E	Controller deviation
Kp	Proportional coefficient
Tn	Reset time
Tv	Derivative time

Since the digital controller is a discrete-time system, the integral is replaced by a summation and the differential by a difference:

$$y = Kp\left(e_i + \frac{Ts}{Tn} \sum_{m=-\infty}^{m=i} e_m + \frac{Tv}{Ts}\left(e_i - e_{i-1}\right) \right)$$

Ts	Sampling time

The following equation puts the controller into practice within the software:

$$y = 0{,}1 \cdot P \cdot e_i + 0{,}001 \cdot I \cdot \sum_{m=-\infty}^{m=i} e_m + 0{,}1 \cdot D \cdot \left(e_i - e_{i-1}\right)$$

Parameters P, I and D are calculated as follows:

$$P = 10 \cdot Kp \quad I = \frac{1000 \cdot Kp \cdot Ts}{Tn} \quad D = \frac{10 \cdot Kp \cdot Tv}{Ts}$$

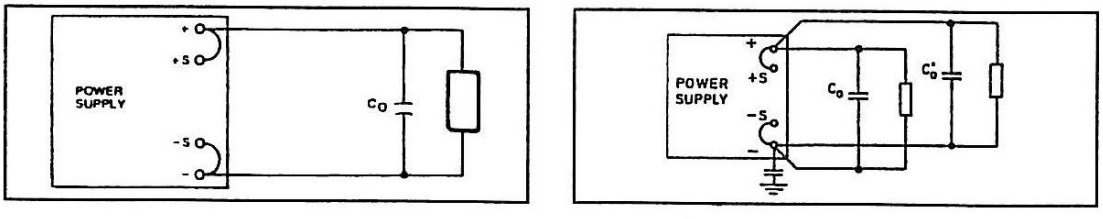
Ts	Sampling time = 300 us

Controller parameters can be programmed via digital interface using the command ***REGLER***.

SENSE MODE

LOAD CONNECTION WITHOUT SENSOR CONDUCTOR

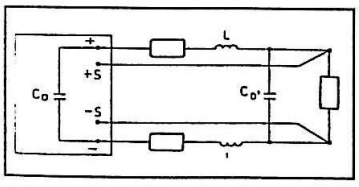
Almost all our power supplies are provided with sensor conductor connectors to compensate the voltage drop on the load. In case, these connectors are not in use, they must be short-circuited with correct polarity to the load outputs and directly to the output connectors. By no means, current may flow over the sense connectors. In case of multiple loads, the user has to provide a central load distribution point. To reduce peak loads and for an HF impedance terminator, a 1-10 µF capacitor should be connected to the output.

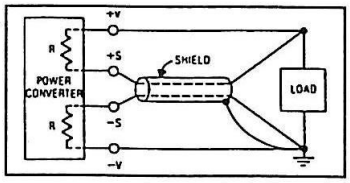


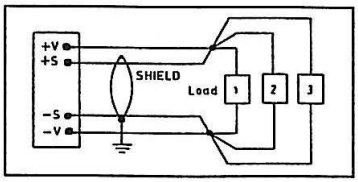
LOAD CONNECTION WITH SENSOR CONDUCTOR

The following points must be considered, when existing sense cables are connected directly to the load or to the central load distribution point:

- remove existing sense cable bridges from the power supply
- directly connect + sense and - sense with correct polarity to the load distribution point
- connect + sense and - sense conductors to a 1-47 µF capacitor
- protect sense cable or at least twist + sense and - sense
- select load line cross section, so that voltage drop is < 0.4 V
- avoid overload of power supplies (voltage drop per line x current)



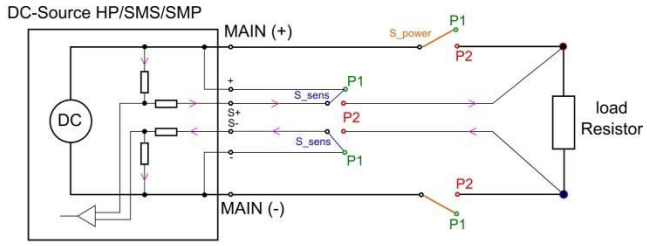


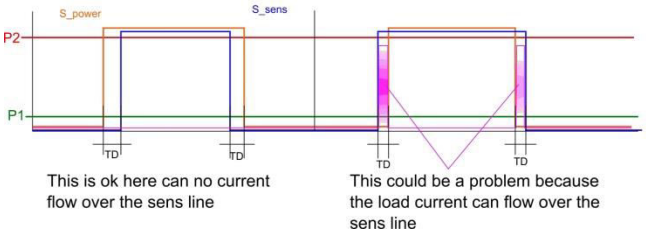


If thus you paid attention to the points stated above, oscillation occurs through load or power induction and complex load situations, please contact our company ET System.

WARNING INSTRUCTIONS FOR USING RELAYS TO THE LOAD DRAFT

In an application where the load is for example should be dropped with a relay and the Sens is used at the same time, care must be taken to ensure that the load current cannot flow through the sensing lines as this can lead to the destruction of the sensor. This is shown schematically in the following figure.

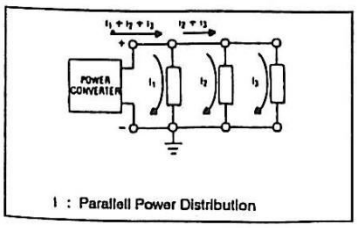


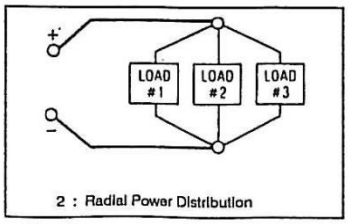


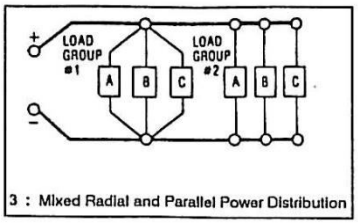
The circuit breaker (S_power) must be closed when starting before the Sens (S_sens). When switching off, the Sens must first be opened and then the circuit breaker can be opened. Otherwise, a current flow may occur across the sensing line, and this may be particularly critical when disconnecting.

LOAD DISTRIBUTION WITHOUT SENSOR CONDUCTOR

To ensure a proper use, a central load distribution situation is essential. Illustration 2 shows a correct load distribution. Illustration 1 shows an insufficient supply of load 2, load 3 etc. via parallel load conductors. In practice, it may occur that an optimal distribution is not possible. Illustration 3 shows a mixed distribution, where at least the largest consumers are supplied centrally.







MASTER/SLAVE MODE (M/S MODE)

In master/slave mode, multiple LAB/HP units are connected via the ETS-Bus. To establish the connection, any commercially available USB cables Type A are used. However, the interface is not an USB interface.

The ETS interface must not be connected to an USB interface!

The interface has two connectors which are connected in parallel. By these, multiple units can be easily connected in parallel. When multiple units are connected and active, each unit has assigned its own address. A symbol in the upper right corner of the display indicates that the units are operating in M/S mode. There is no *‚Master'* in the narrow sense. Set points are forwarded via bus to all connected units. On each unit, the parameters can be adjusted. Changes are automatically forwarded via ETS bus to all connected units. It is irrelevant, whether the set points are adjusted using the front panel or via interface. The command LLO on a digital interface deactivates front panel operation at all connected units.

Example: 2 units connected to the bus, unit 1 with front panel operation and digital interface, unit 2 with front panel operation only

GTR	Remote operation mode, set points can be adjusted via digital interface or via front panel of unit 2. Unit 1 could be toggled to local mode by pushing the button Standby. The display of unit 1 shows the word ‚Rem' (Remote), the display of unit 2 shows the word ‚Loc' (Local).
LLO	Local lockout, both units cannot be operated via front panel. This status is indicated on both displays by the word ‚LLO'.

Note: Master/Slave mode is currently not working in combination with memory card!

If set points are given via analog interface, only one unit must be run via AI!

OPERATION MODES IN MASTER/SLAVE MODE

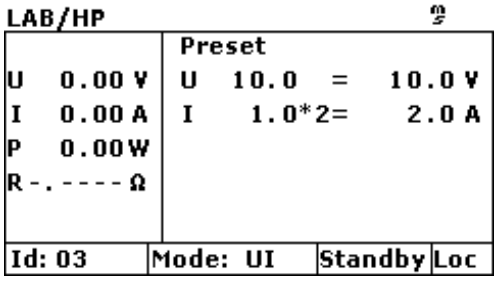
The master/slave mode can be selected in the configuration menu of the unit.

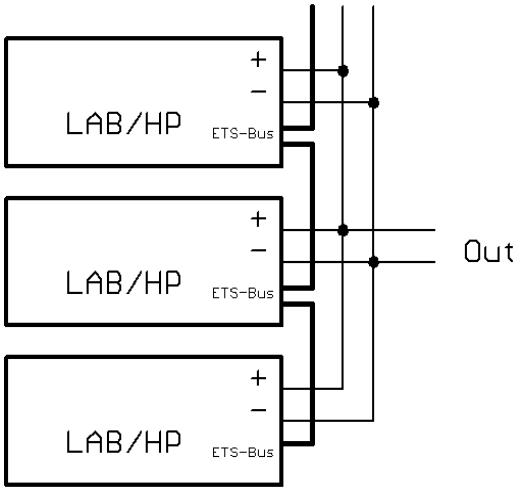
M/S MODE OFF

No active master/slave mode, regardless of whether units are connected or not.

M/S Mode Parallel

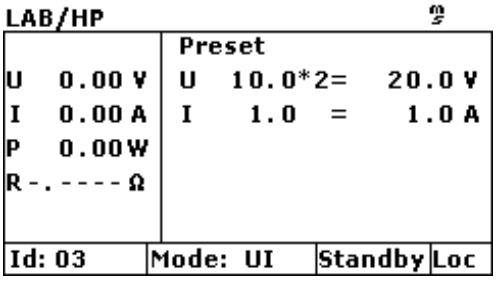
The control assumes that outputs are connected in parallel. Set points are respectively converted. Displays will show the total current as measure point. Current distribution between the individual units is not necessarily symmetrical. Thus, the total current will be limited to the adjusted value.

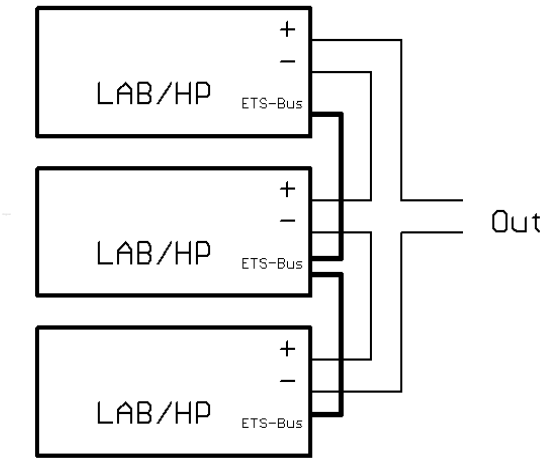




M/S mode Serial

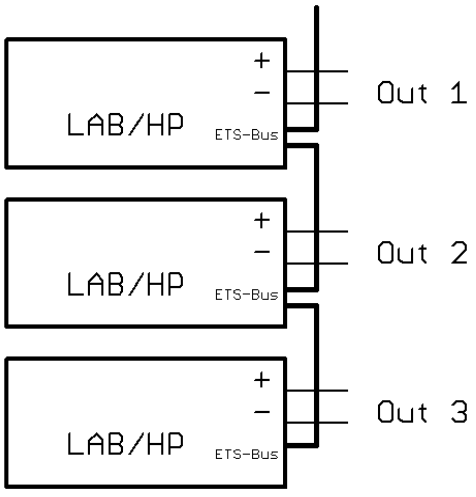
The control assumes that outputs are connected in series. Set points are respectively converted. Displays will show the total voltage as measure point. Voltage distribution between the individual units is not necessarily symmetrical. Thus, the total voltage will be limited to the adjusted value.





M/S mode Independent

The control assumes that the outputs are independent. Set points are exchanged via bus only. The display equals the standard display.



OVERVIEW OF THE CONNECTED UNITS

Pushing the button ***Display*** twice will open a menu, which displays the data of the first four LAB/HP units connected to the bus. Indicated are voltage, current and power of the individual units. Additionally, the complete data of the system will be displayed.

LAB/HP

Id	U[V]	I[A]	P[W]
02	0.0	0.0	0.0
03	0.0	0.0	0.0
Sum	0.0	0.0	0.0

Id: 03	Mode: UI	Standby	Loc

CONTROLLING THE UNIT IN MASTER/SLAVE MODE VIA DIGITAL INTERFACE

Set points that are sent via digital interface define the set points for the presently connected device. These set points are also transmitted to the other devices, which means that the total voltage and the total current can be higher.

Example: 3 devices on the bus

GTR	Remote operation mode active
OVP,30	Adjust over voltage protection to 30 V
IA,10	Adjust output current to 10 A
UA,15	Adjust output voltage to 15 V
SB,R	Output open

All devices connected to the bus are adjusted to 15 V/10 A. When these devices are parallel connected, the resulting output voltage is 15 V and 30 A (= 3 x 10 A). When the devices are serial connected, the resulting output voltage is 45 V (= 3 x 15 V) and 10 A.

The measurement values consider the selected configuration of the unit. The commands ***MU*** and ***MI*** can be used to read the total voltage and the total current of the whole system. Individual data for each device connected to the bus can be read using a parameter.

Example: 3 devices on the bus in parallel mode

GTR	Remote Operation Mode active
OVP,30	Adjust Over Voltage Protection to 30 V
IA,10	Adjust Output Current to 10 A
UA,15	Adjust Output Voltage to 15 V
SB,R	Output open
MI	Measures present current
MI,28.4A	Unit answers: 28,4 A
MI,0	Measures present current of the first device
MI,9.1A	Unit answers: 9,1 A
GTR	Remote Operation Mode active
MI,9.4A	Unit answers: 9,4 A
MI,2	Measures present current of the third device
MI,9.9A	Unit answers: 9,9 A

CHANGING THE MASTER/SLAVE MODE VIA DIGITAL INTERFACE

MS[,{P|S|I|O}]	MS without parameter returns the current setting and status
MS,<Mode>,<Status>	Mode = "Parallel","Serial","Independent" or "Off" Status = Off or the actual adress
MS[,{P|S|I|O}]	MS with parameter configures the M/S-Mode
Parameter:	P Parallel S Seriell I Independent O Off

Notes:

The changes are saved permanently.
The individual data of the measured values can be accessed via the normal measurement commands (with parameters) can be queried.
E.g. MU,2 returns the output voltage of the 2nd slave
The number of connected bus participants can be queried via the STATUS command.

Example:

Command:	Answer:	Note:
GTR	-	Remote Operation Mode active
MS,P	-	sets devices to parallel mode
MS	MS,Parallel,1	device in parallel mode, address 1
UA,10	-	sets output voltage to 10V
IA,1	-	sets output current to 1A
SB,R	-	output active
MU	MU,10.00V	shows the total output voltage
MU,1	MU,10.00V	shows the output voltage of device 1

APPENDIX

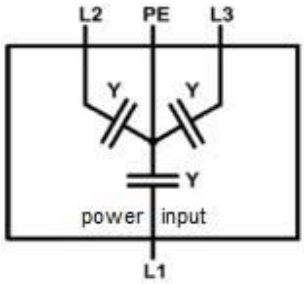
EQUIVALENT LEAKAGE CURRENT MEASUREMENT ACCORDING TO VDE 0701

The equivalent leakage current measuring according to DIN VDE 0701-1 may deliver results beyond the norm.
Cause: Measurements are primarily performed on so-called EMC-filters at the AC input of the units. These filters are built symmetrical, that means capacitors are installed between L1/2/3 and PE. While measuring, L1, L2 and L3 are connected together and the current flow to PE is measured. Therefore up to 3 capacitors are connected parallel which doubles or triples the measured leakage current. This is permissible according to the norm.

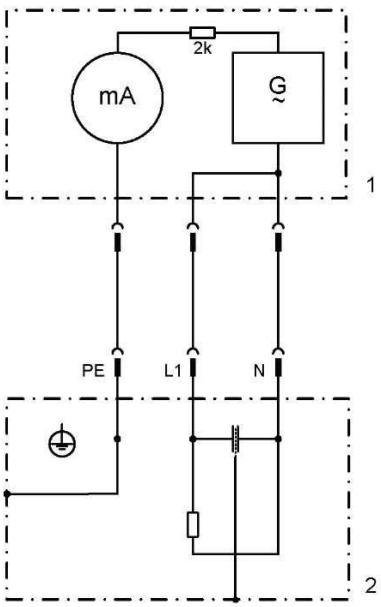
Quotation from the norm of 2008, appendix D:

> *„When measuring protection conductor currents with the equivalent leakage current measuring method, it is important to note that devices with protective grounds and symmetrical circuits may have results, due to the wiring, that are up to three or four times higher than the leakage current of one phase.“*

Graphical representation of a balanced circuit:



Example illustration from the norm protective ground measuring - equivalent leakage current measuring method:



Note: The illustration shows the measurement method for two-phase power supplies. In the three-phase version, phase N is replaced by L2 and/or L3.

Configuration Oft the Ethernet (LAN) interface

Table of contents

INTRODUCTION

The Ethernet interface of the ETS units is implemented internally with an Ethernet serial converter (type XPORT) from Lantronix.

http://www.lantronix.com/device-networking/embedded-device-servers/xport.html

On the homepage of Lantronix there is a lot of information about the device. On this page there is also a tool "Device Installer" for searching and configuring the interface modules.

http://www.lantronix.com/device-networking/utilities-tools/device-installer.html

However, the configuration is also possible with Windows and Linux on-board tools.

This white paper shows the configuration and setting of the LAN interface as an example. The settings have been tested on computers with the operating systems Windows 7, Windows 10 and Linux Mint.

No warranty is given for possible damages. Trademark rights of the companies mentioned are expressly recognised. Third-party rights, in particular for the tools used, must be observed.

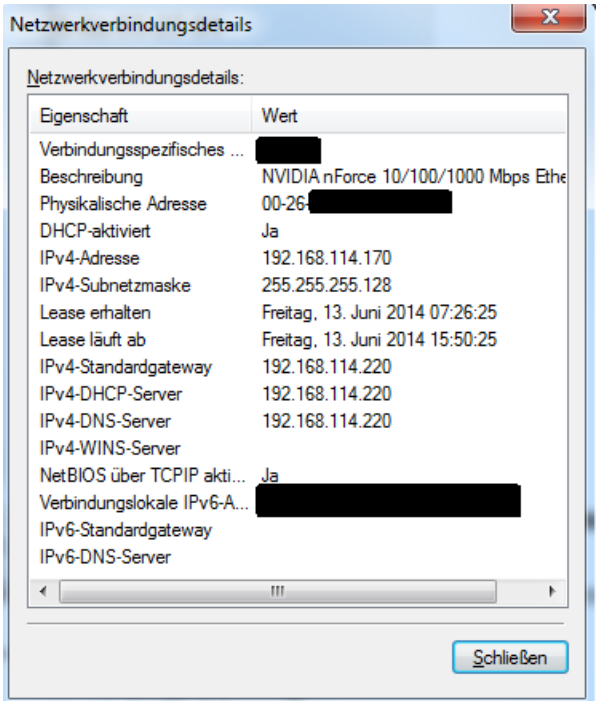
SELECTION OF THE IP ADDRESS

To communicate with the EAC via a network, the unit must first be assigned an IP address. When the units are delivered, the unit automatically obtains an IP from the network. In practical operation, however, this is unfavourable because the unit has a different IP address after it is switched on again. Therefore, each unit should be assigned an individual, fixed IP address.

The IP address must be in the "reachable" address space. To select a suitable IP address, it makes sense to first look at the current configuration.

Check the status of the LAN connection (Windows):
Start → Control Panel → Network and Internet → Network and Sharing Centre

Click on "LAN connections" under "Connections". Click here on "Details". A window appears with information about the current LAN connection.



In this example, the IP address of the computer is 192.168.114.170
The IP address of the server is 192.168.114.220
The subnet mask is 255.255.255.128

Query the status of the LAN connection (Linux):
Command: ip addr

The reachable address space is within the '0' in the subnet mask. The upper bits must remain unchanged.

The following table shows the connection between IP addresses and subnet masks:

	Dezimal	Hexadezimal	Binär
Subnetz	255.255.255.128	ff ff ff 80	1111 1111 1111 1111 1111 1111 1000 0000
IP-Adresse	192.168.114.170	c0 a8 72 aa	1100 0000 1010 1000 0111 0010 1100 1100
IP-Adr. Gateway	192.168.114.220	c0 a8 72 dc	1100 0000 1010 1000 0111 0010 1101 1100
Höchste Adresse	192.168.114.255	c0 a8 72 ff	1100 0000 1010 1000 0111 0010 1111 1111
Kleinste Adresse	192.168.114.128	c0 a8 72 80	1100 0000 1010 1000 0111 0010 1000 0000

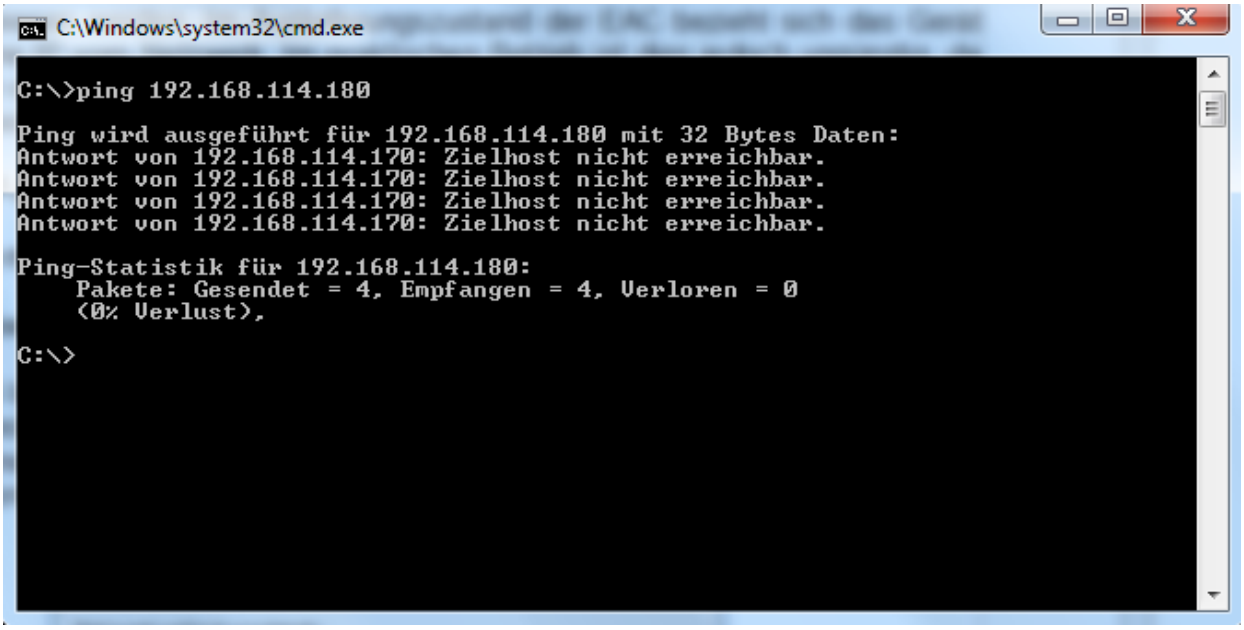
This means that the address range that can be reached is 192.168.114.128 to 192.168.114.255.

Usually a few addresses in the lower and upper range are reserved in the network and may therefore not be used. In this example, the addresses 192.168.114.170 (own computer) and 192.168.114.220 (gateway) are also assigned. Therefore, the address 192.168.114.180 is selected here.

To check whether this address is still free, a ping command is sent to this address:

Open the console:
Admin rights are required on the console for later entries. Therefore, the console is opened immediately with the corresponding rights:
Start → All Programs → Accessories → Right-click on Command Prompt → Run as Administrator

After confirmation, a console window opens. Enter the command "ping <ip address>".
If the answer is "Destination host not available", the address seems to be free.



CONFIGURATION VIA DHCP

This method only works if the unit has received an IP address from a DHCP server. This is the case in the usual networks. This does not usually work with a direct connection between the device and the laptop.

In the factory setting, the DHCP name is Cxxxxxx. Here xxxxxx stands for the last 6 digits of the MAC address. The unit can then be reached in the browser with http://Cxxxxxx. Further configuration is then carried out as described in section "Setting the IP address via the browser" (chapter 7, page 10).

Example: The MAC address of the unit is 00-20-4a-93-27-51.
The DHCP name is C932751
Command line in the browser: http://C932751 resp.http://C932751/

MANUAL ASSIGNMENT OF AN IP WITH ARP

This method works in the network and with a direct connection device - laptop. Devices with static IP cannot be found. With Linux, the network adapter should be set to "Link Local Only" (IPv4).

The following commands are entered via the console. The arp command must be executed with admin rights. For Windows, the console (cmd.exe) should be started with the right mouse button and "Run as administrator".

The address must first be entered in the ARP table in conjunction with the MAC address. This is done with the command

Windows: **arp -s xxx.xxx.xxx.xxx yy-yy-yy-yy-yy-yy zzz.zzz.zzz.zzz.zzz**
Linux: **sudo arp -s xxx.xxx.xxx.xxx yy:yy:yy:yy:yy:yy zzz.zzz.zzz.zzz.zzz**
xxx = desired IP address
yyy = MAC address of the unit (see back of unit)
zzz = own IP address (not necessary, if there is only one network network adapter and also no virtual adapters are set up)

In this example, the desired IP address is 192.168.114.180 and the MAC address of the unit is 00-20-4a-93-27-51. The own IP address is 192.168.114.170 (see last section).

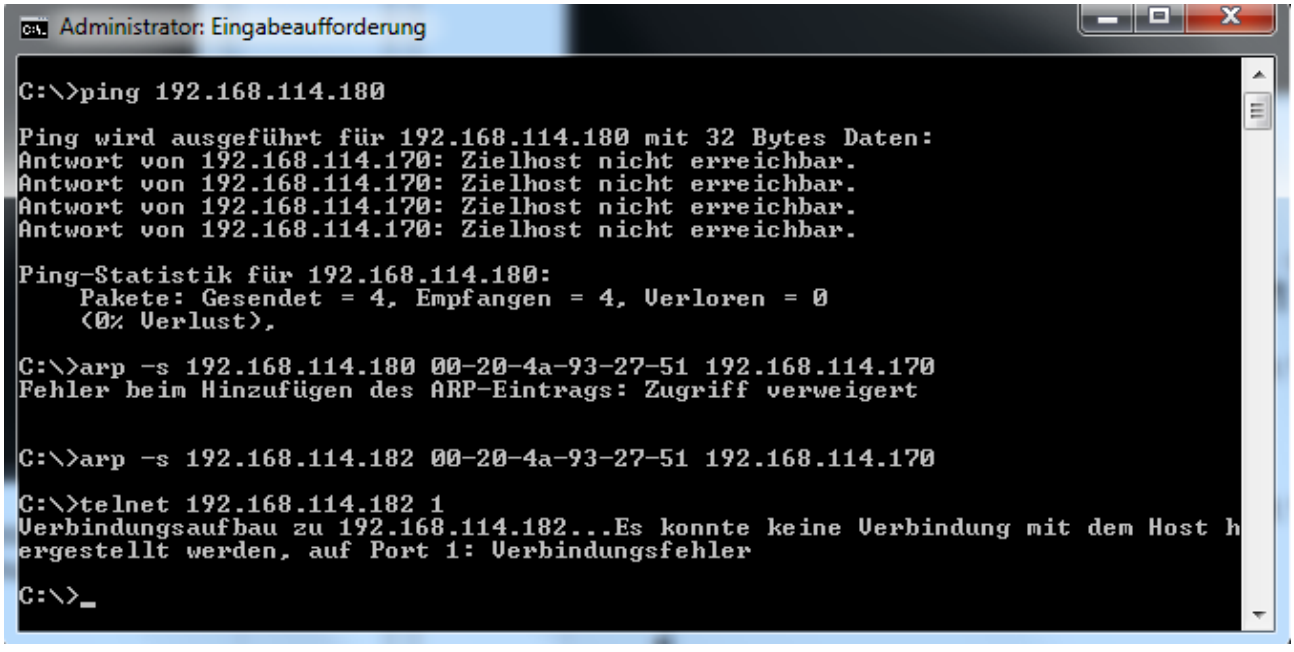
If an error message appears (as in the screenshot), the IP address is probably entered in the network but is currently not available. In this case, another address must be selected (here 192.114.182).

If there is no error message, the IP entry has been added to the ARP table, but the unit does not yet have a new IP address. To address the IP address, a telnet with the new IP address is executed on port 1. The command is:

telnet xxx.xxx.xxx.xxx 1

xxx = Wanted (new) IP address

The connection is not completed but the IP address is now temporarily assigned to the unit!



Telnet is no longer installed by default as of Windows 7. If the error message "The command "telnet" is either misspelled or could not be found" appears, telnet must first be activated:

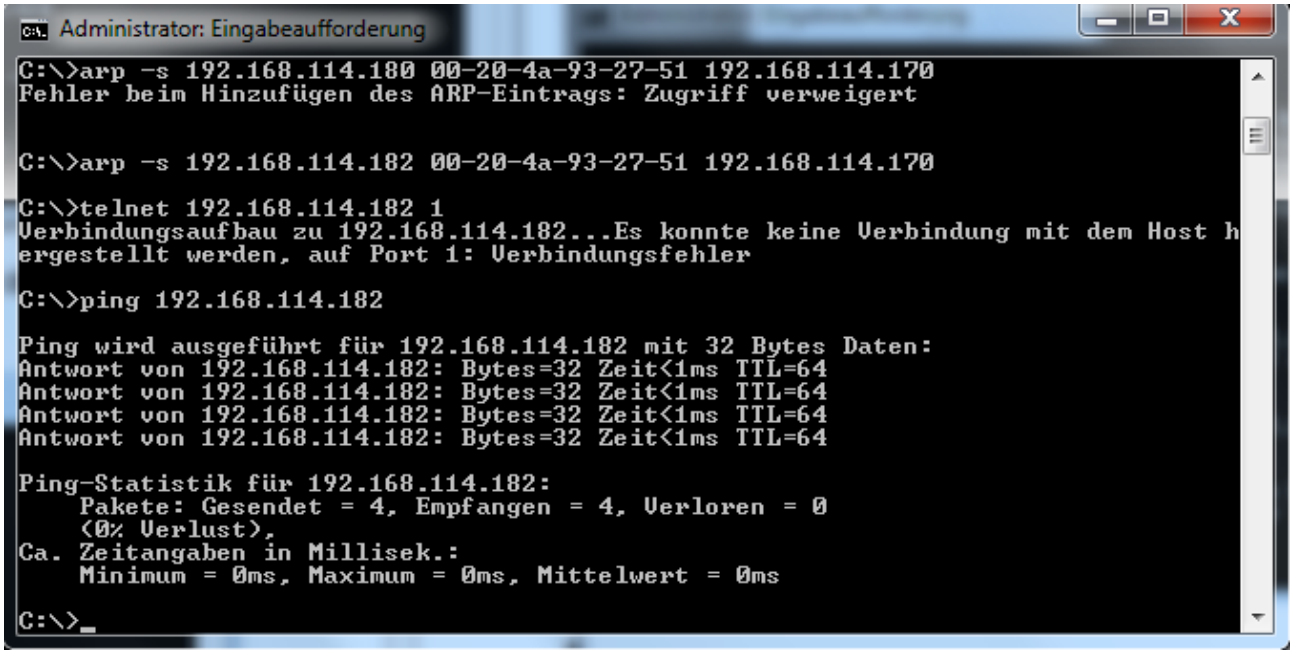
Windows 7:

1. *Start → Control Panel → Programs → Enable or Disable Windows Features ".*
2. *Haken bei „Telnet-Client“ setzen.*
3. *Ok*

Windows 10:

1. *In the file explorer, enter "Control Panel\Programmes\Programmes and Features" as the path.*
2. *Windows-Features aktivieren oder deaktivieren*
3. *Check the box for "Telnet client".*
4. *Ok*

With a new ping, it can be verified that the device has taken on the IP:

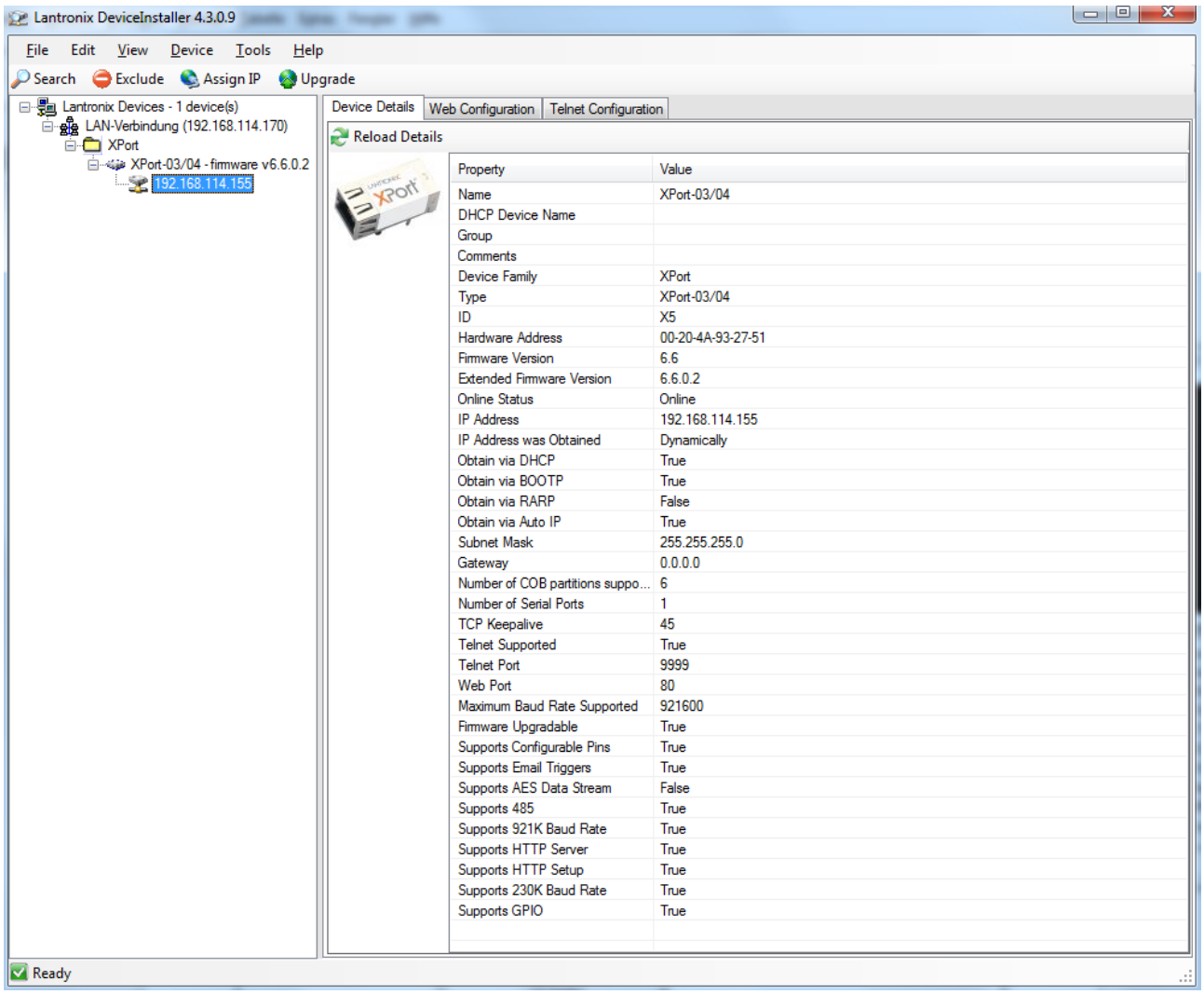


The IP configuration is still dynamic, so the setting will be lost if the unit is disconnected from the network. For further configuration, one can either work with Telnet (section 6, page 9) or continue the configuration with a browser (section 7, page 10).

IP DETECTION WITH THE DEVICE INSTALLER FROM LANTRONIX

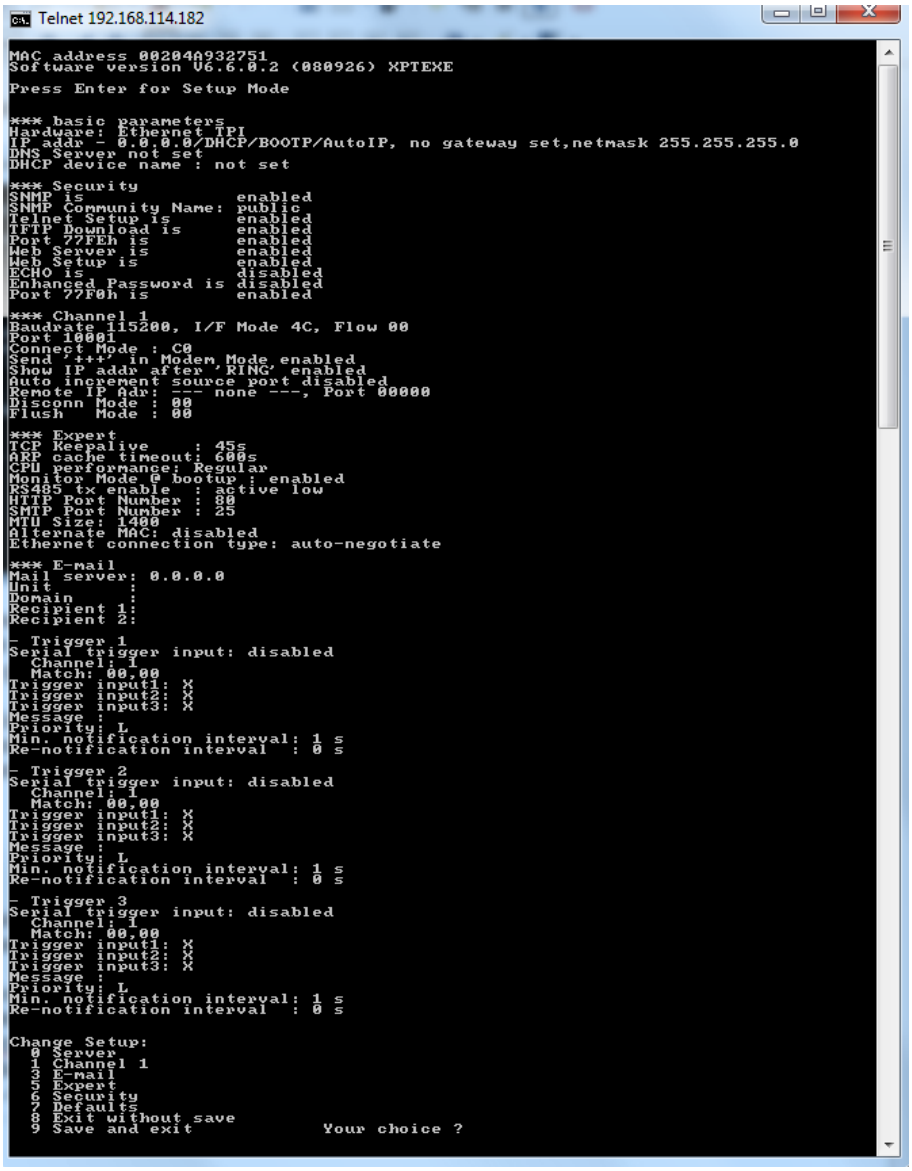
This method works in the network and with a direct connection device - laptop. With Linux (WINE), this programme does not run stably at present. With Windows, the firewall for the Ethernet interface should be deactivated.

With the Device Installer, Lantronix offers a tool that allows the unit to be found easily in the network. After starting the programme and pressing the Search button, all XPORTS in the network are displayed. The currently given (dynamic) IP is also displayed. This can then be entered in the address line of a browser and the configuration carried out as described in Section 7, page 10. Alternatively, a Telnet configuration can be carried out according to section 6, page 9, by clicking on the tab "Telnet Configuration".



CONFIGURATION VIA TELNET

The interface parameters can be changed via a telnet connection on port 9999. The command in this example is "telnet 192.168.114.182 9999". The configuration menu can then be started by pressing the enter key. The current settings are displayed and a selection menu for configuration is offered.



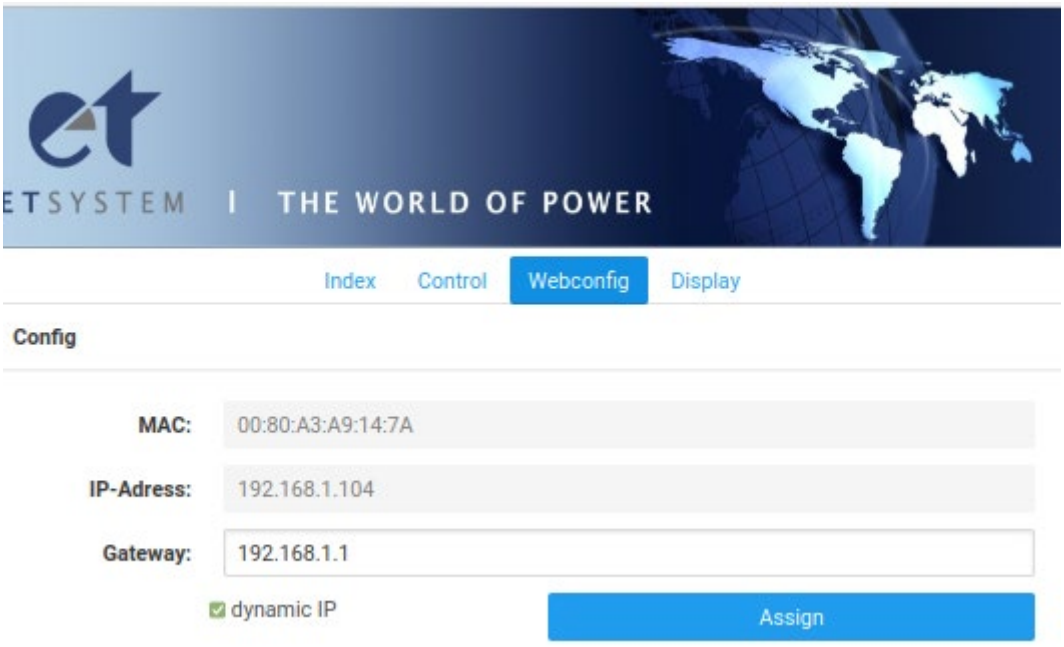
To set the IP address permanently, we need the menu "Server" (selection 0). Now the IP address is entered again (finish all four groups of digits with the enter key). The other settings remain unchanged (simply press the enter key). Then the configuration is saved and ended by selecting menu item 9.

The unit now has a fixed IP, this should be noted down without fail!

SETTING THE IP ADDRESS VIA THE BROWSER

This method only works with older JAVA versions and is therefore outdated!

If the IP address has been assigned, it can now be entered in the address line of the browser. The start page appears. The second entry leads to the configuration menu.



To configure the IP, uncheck Dynamic IP and enter the IP address. After confirmation via Assign, the new (static) address is saved. It is possible that the connection will be interrupted shortly because the interface is performing a reset.

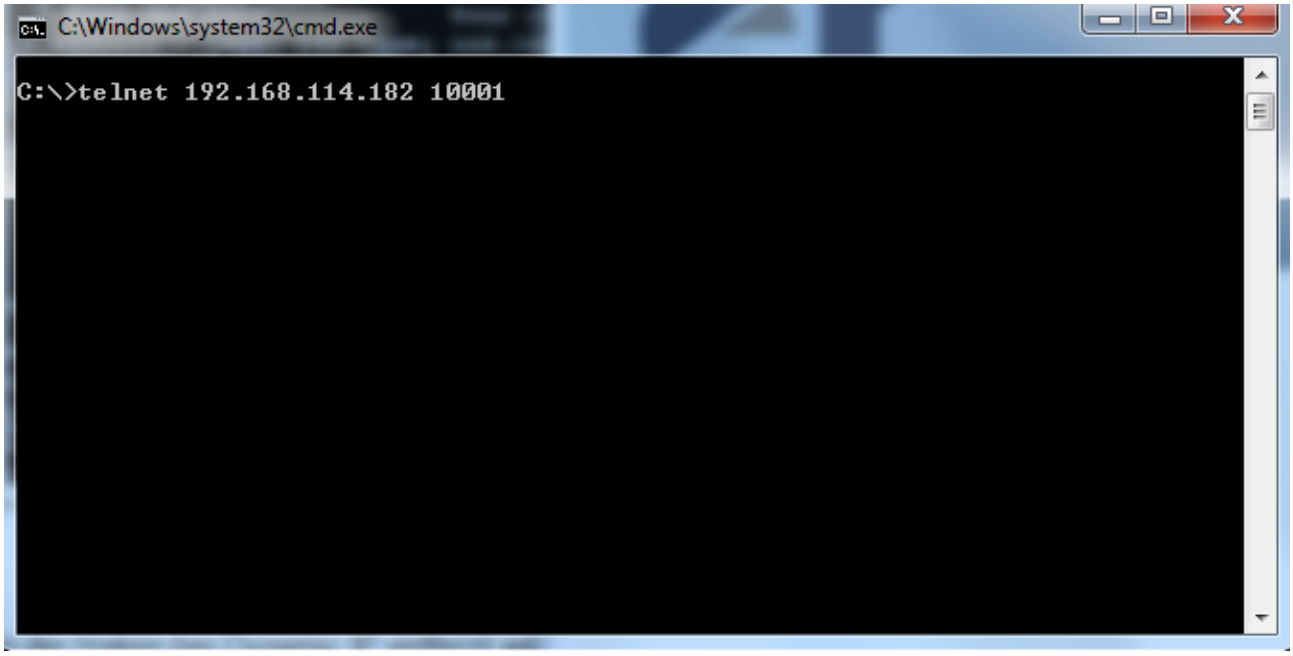
The setting for the gateway can be left at 0.0.0.0 in most cases.

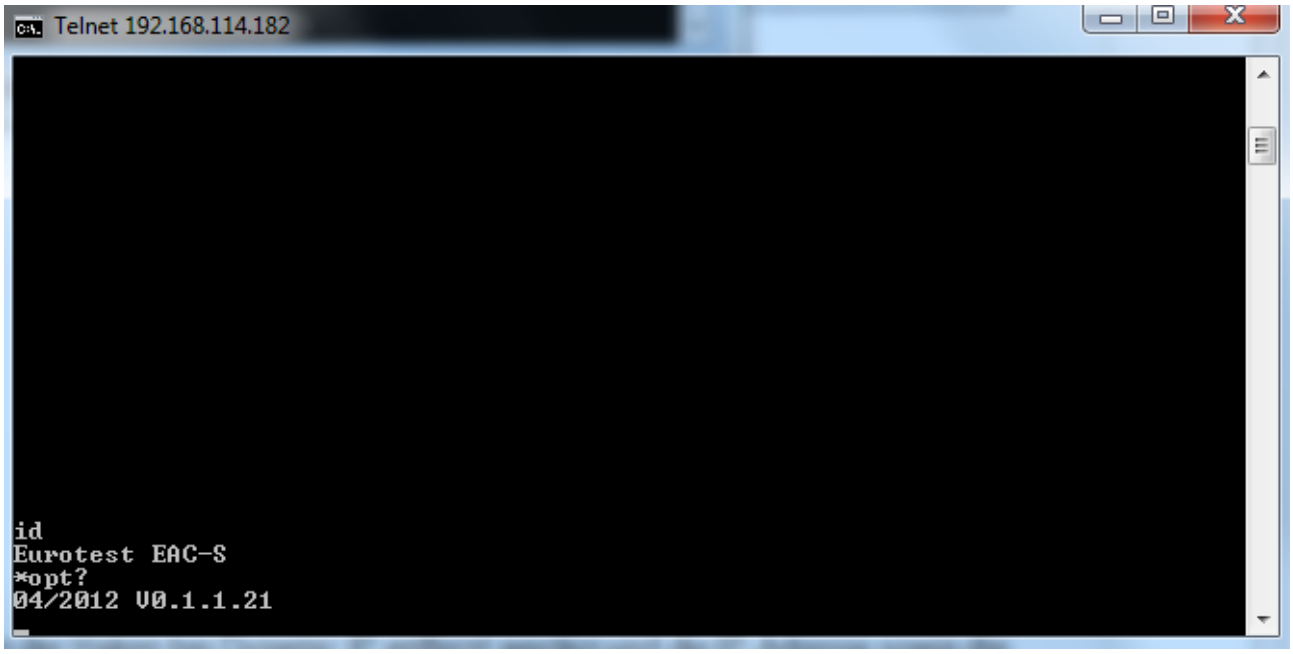
The unit now has a fixed IP, this should be noted down without fail!

CONTROL OF THE UNIT VIA TELNET

The unit can be controlled directly via port 10001:

Open the console: Start → Run → enter "cmd" or "command". DOS window opens, commands can be entered directly
telnet xxx.xxx.xxx.xxx 10001



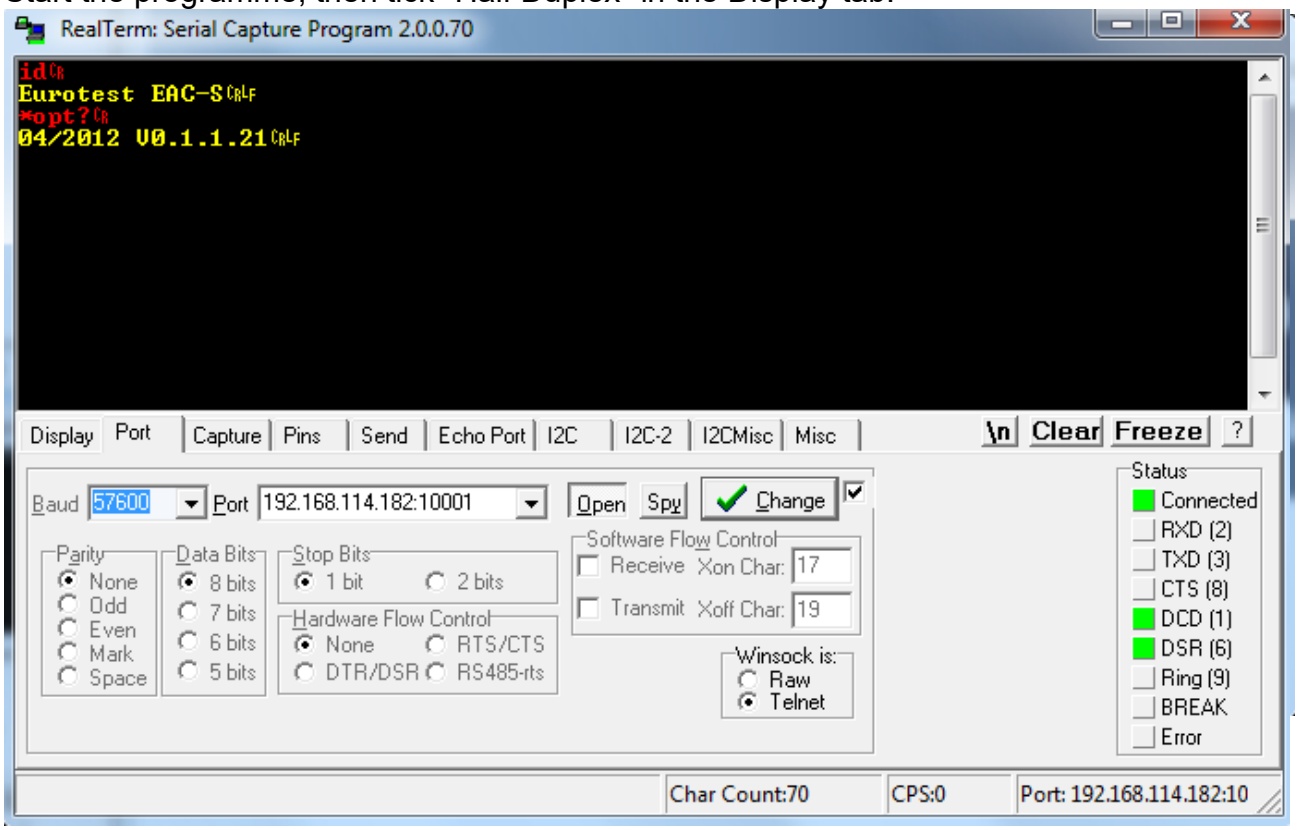


When controlling the units via port 10001, the user interface must not be started in a browser! As an alternative to Telnet, many terminal programmes have the option of establishing a TCP/IP or Telnet connection.

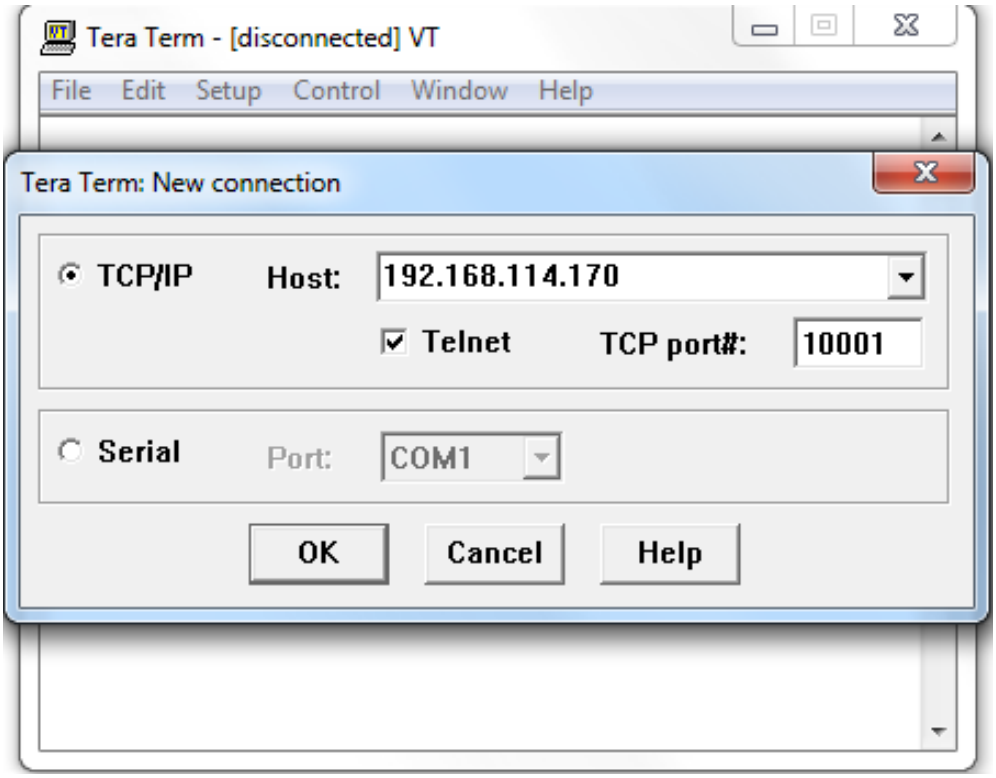
1.1 Telnet Connection with Realterm

Realterm is an Open Source Terminal programme.
http://realterm.sourceforge.net/

Start the programme, then tick "Half Duplex" in the Display tab.



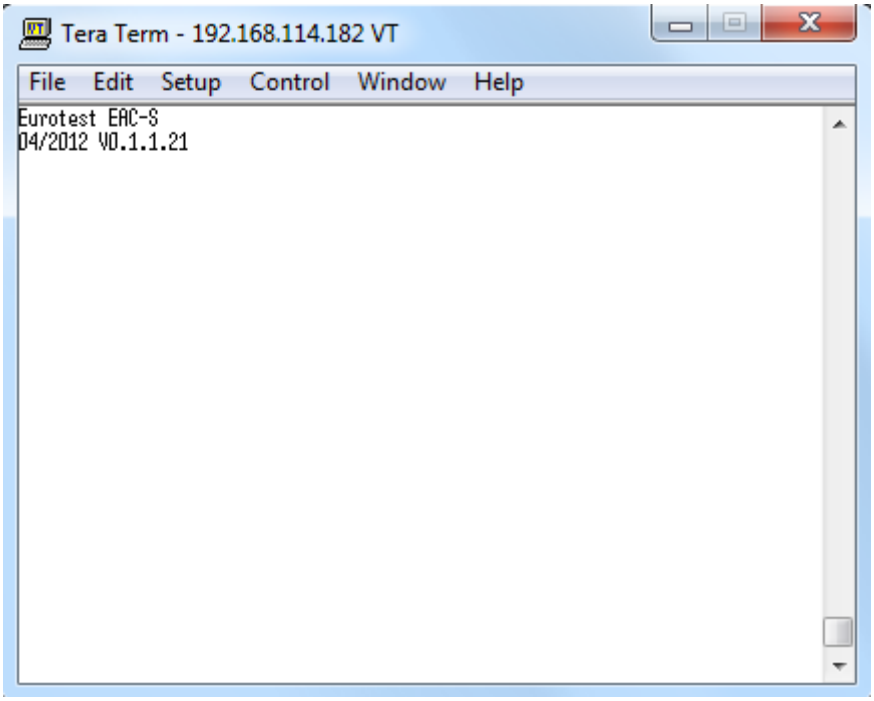
Now enter the IP address in the form xxx.xxx.xxx.xxx:10001 in the "Port" tab and press the Open button. Commands can now be sent to the unit in the terminal field.



1.2 Steuerung über Tera Term

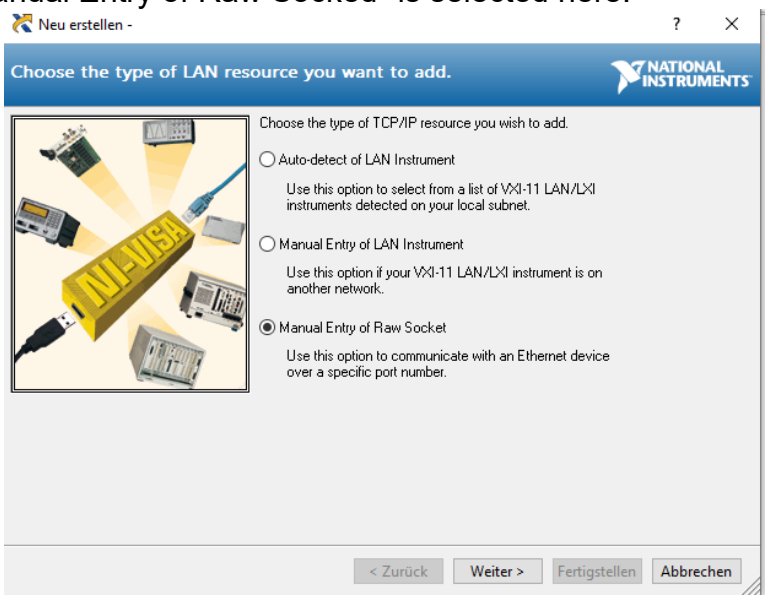
Tera Term is a free, open-source terminal emulator. After installing and calling the programme, enter the IP address and the port.

So that you can see your own entries, it is advisable to tick the box
Setup → Terminal → Local echo. Now commands (e.g. Id) can be sent to the unit in the main window.

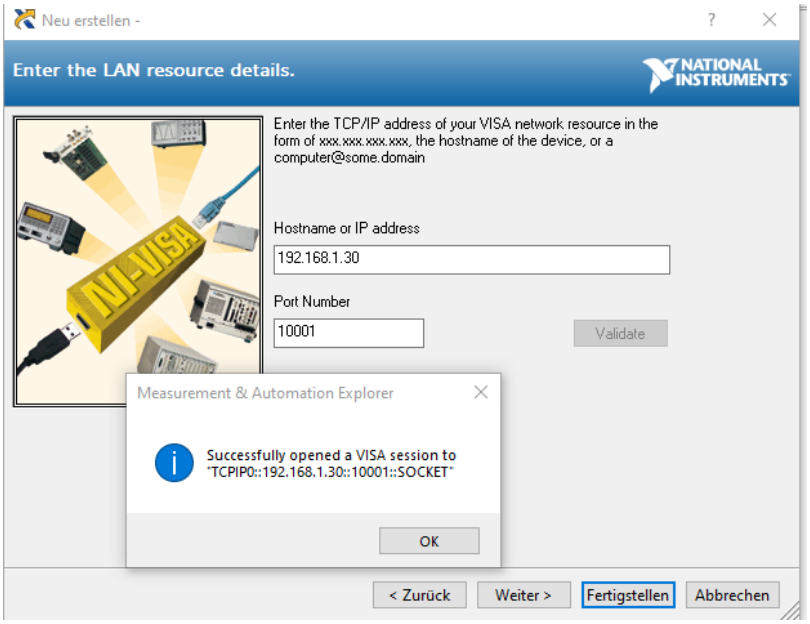


LABVIEW

Include the VISA resource:
Call up NI-MAX.
In Devices and Interfaces → Add Network Device → VISA TCP/IP Resource.
The option "Manual Entry of Raw Socked" is selected here.



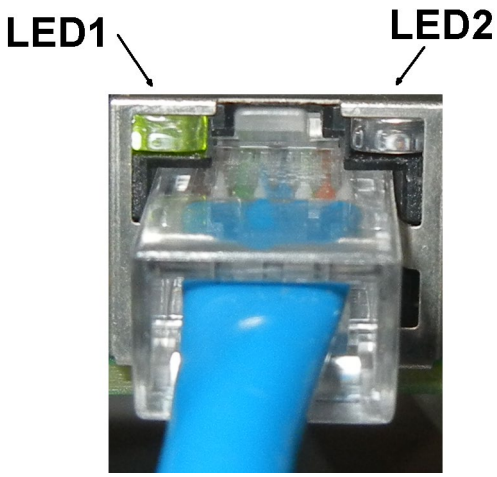
Now the IP address and the port number (10001) are entered. The connection can be checked with Validate.



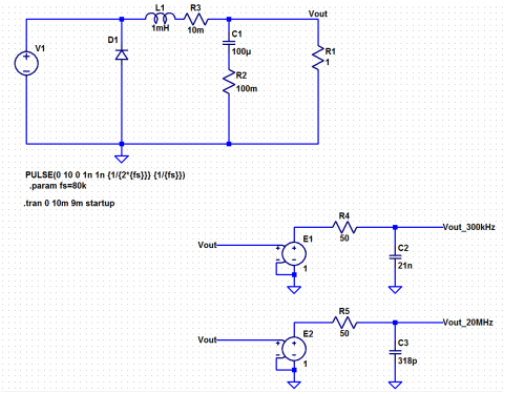
The VISA resource name is composed as follows:
<interface>::<IP address>::10001::SOCKET
z.B. TCPIP0::192.168.1.30::10001::SOCKET

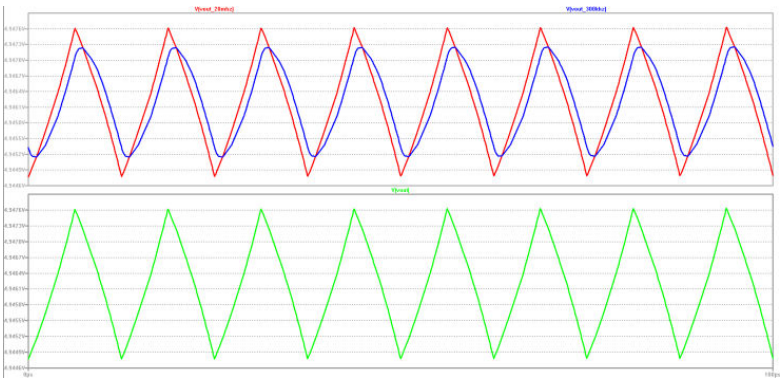
LEDS

Colour	LED1	LED2
Off	No connection	No activity
Yellow	10 Mbps	Half Duplex
Green	100 Mbps	Full Duplex



ET-SYSTEM RIPPEL MEASURMENT SPECIFICATION





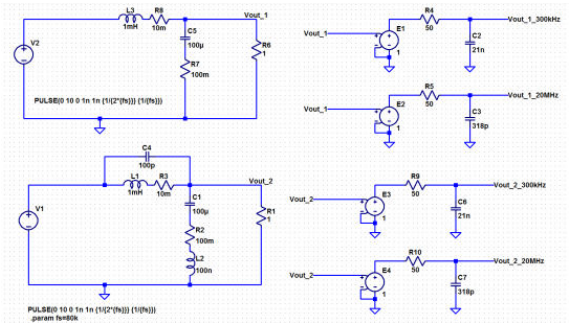
Theoretical Analysis

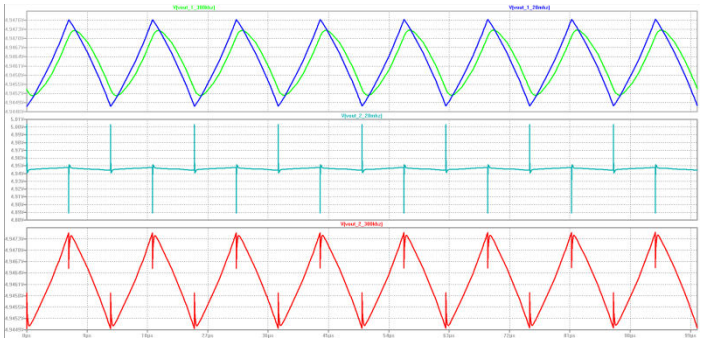
The component of the output ripple is built by the output current and the equivalent series resistor of the output

capacitor. Picture 1 show a basic circuit which was used to simulate the ripple.

Picture 2 show the ripple without spikes. Picture 2 shows also the different between the used measurement bandwidth. At this example the switching frequency of the converter was 80kHz (this is also the switching frequency of the LAB/HP and LAB/SMS series).The red line shows the measured ripple by using a bandwidth of 20MHz and the blue line shows the measured ripple by using a measure bandwidth of 300kHz.

This example shows that the measurement bandwidth have a strong influence of the measurement result.



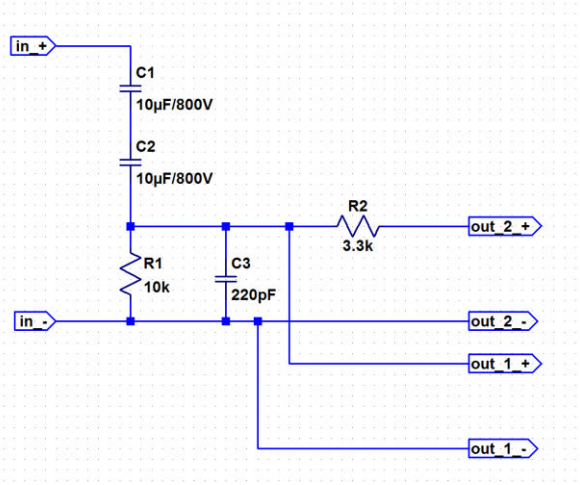


The spike or noise of the ripple will generate by the switching noise of the power supply. The spikes which will be measured strongly depend on the used measurement method. One point is the using measurement bandwidth the other point is the test setup. The influence of the measurement method is show at picture 4. Picture 3 show the previous know circuit and also the same circuit with some added leakage component how are contribute to the output noise.

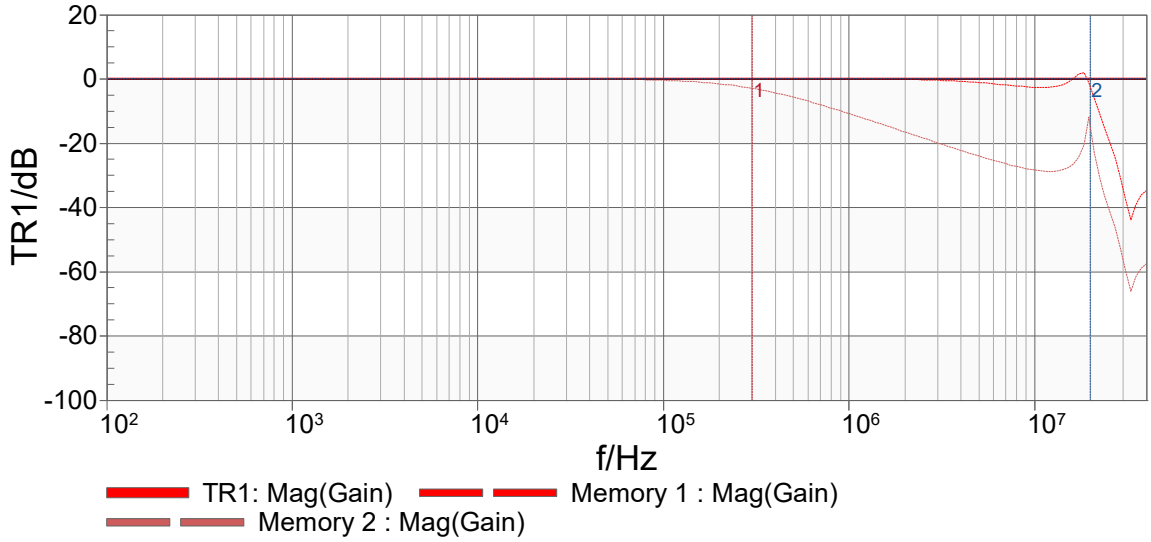
This example show that the measurement bandwidth do influence the spikes or noise measurement.

PRATICAL RIPPEL MEASURMENT.

ET-System measured the ripple with the test setup how is show at picture 5. Tow high voltage capacitor in serie with a 10k Ohm resistor is use to measured only the AC-Component of the output voltage of the power supply. The circuit have tow output. Output 1 have a measurment bandwith of 20MHz and output 2 have a bandwith of 300kHz. This rippel circuit was build at the labortory and was tuned by using a frequency analyser (Bode 100). Also the used 1:1 Oscilloscope probe was during the tuning procedure connectet to the rippel measurment setup to elemenate the influence of the probe to the measurment bandwith.



Picture 6 show the result of frequency analyses of the tuning measurement. Point 1 shows the 3dB point of the 300kHz output. Point 2 show the 20MHz point.



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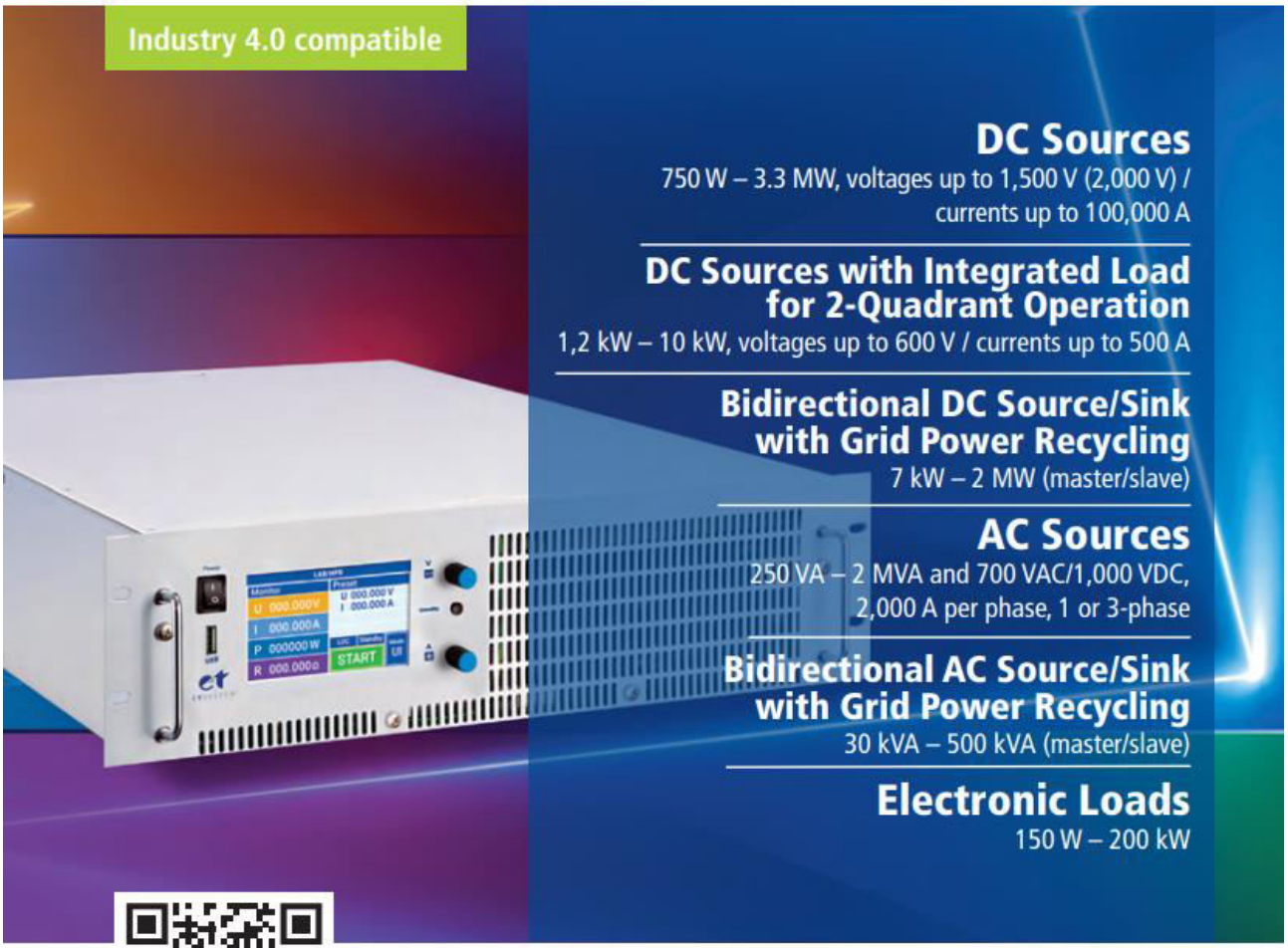

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