



OPERATING MANUAL

Electronic Load ESL and EDL





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Colour : green : only EDL
Colour : blue : options



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1. Initial checks



Examine the shipping carton for damage before unpacking the unit

1.1 Visual inspection



Examine the unit for transport damage

1.2 Mains operation

A power cable is supplied.



Input Mains Voltage: 230 VAC +-10% / 47-63 Hz

Damage due to incorrect mains supply is not covered by the warranty

1.3 Mains switch and Fuse

The main socket and fuse (1,0 AT) will be found at the rear of the unit. The Mains switch will be found on the front panel.

1.4 Warm up

The warm up time up to the reaching of the indicated accuracy amounts to 20 minutes with an ambient temperature of 23 degrees.



2. Operation

2.1 Switch-on mode

Switch on the unit at the main switch "POWER" at the front of the unit. The following operating conditions are activated after pressing the main switch on the equipment front:

- Unit is in the operating mode "Current constant"
- Unit is in the Stand-By-Mode
- Display "V" shows the voltage on the input.
- Display "A" shows the current on the input (0A).

After press the button Output ON a current (0....max A) can be adjust with the potentiometer. The voltage on the input must be higher then 1 VDC.

2.2 Indications

2.2.1 LCD Display

A LCD display shows all set and measured values.

Following measurements are displayed:

Voltage
Current

Following settings can be made:

Current

Dynamic (only EDL)

Resistance

Frequency impuls in Hz (only EDL)

Impuls in % (only EDL)

Range constant current and constant resistance

Short circuit relay (only with Option –KR)

2.2.2 Error indication

If over voltage, over current, over power or over temperatur arises, the display shows "Error". After the cause of the error the load can be reset by twice pressing the output button.



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2.2.3 POL (PowerOnLast) Function / INFO Function

After switching on the unit, the button POL is activated. By pressing the POL button at the first the last settings before last switching off appears. By pressing the button POL the second time the output button goes in the stored adjustment. The POL function is no longer available thereafter. The button has now INFO function, the type and specification data can be indicated with the INFO button.

The POL button is deactivated after switching on the unit by pressing any button or any turn or press of the potentiometer.

2.2.4 LOCK button

The operation from the front panel can be locked with the LOCK button. The LOCK button can be programmed over the BUS, too. (Local LOCK).

2.3 Operation mode "Constant Current (CC)"

2.3.1 Adjustments

2.3.1.1 Current adjustments

At the potentiometer the load current can be adjusted in the range from 0 A up to a maximum. The actual flowing current on the output, will be shown on the display.

By pressing the potentiometer the dynamic current can be adjusted in the range from 0 A up to a maximum. **(only EDL)**

2.3.1.2 Frequency adjustment (only EDL)

By pressing the potentiometer the frequency can be adjusted in the range from 1 Hz to maximum.

By using the potentiometer the frequency with which the current will change between the static and the dynamic current value can be adjusted.

2.3.1.3 Puls adjustment (only EDL)

By pressing the potentiometer the puls can be adjusted in the range from 5% to 95%.

By using the potentiometer the puls with which the current will change between the static and the dynamic current value can be adjusted.



2.3.1.4 Dynamic operation (only EDL)

The dynamic operation starts by pressing button "Dynaminc". The load switch with adjusted frequency and impuls between static and dynamic current.

2.3.2 Preset function

All adjustments can be preset and displayed on the as settings. By pressing the button Output ON the load will be activated.

2.4 Operation mode „Constant Resistance (CR)“

2.4.1 Adjustements

2.4.1.1 Resistance constant operation

By pressing the button "Mode CR" the electronic load will switch into operating mode „constant resistance (CR)“.

2.4.1.2 Resistance adjustment

On the potentiometer the resistance in the range starting at Rmin can be adjusted.

Rmin = smallest resistance value
 Umax = maximum permissible voltage
 Imax = maximum permissible current

$$R_{min} = \frac{U_{max}}{10 * I_{max}}$$

Example:

Maximum current Imax = 15 A
 Maximum voltage Umax = 60 V

$$\underline{R_{min}} = \frac{U_{max}}{10 * I_{max}} = \frac{60 \text{ V}}{10 * 15 \text{ A}} = \underline{0.4 \text{ Ohm}}$$



2.5 Unter voltage cut off –EUSA (Option)

With the option -EUSA the undervoltage cut off of the load is adjustable from 1V to max voltage. By pressing the potentiometer the adjustments:

UV cut off and UV turn on

can be made.

The value for the UV turn on must be ever more large then the value for UV cut off. The value of hysteresis (UV turn on minus UV turn off) should be selected as a function of the current. The more larger the current, the more larger the hysteresis. If the UV cut off is active, then the status is displayed, ABS is indicated with one point.

This option is available only for the loads of the series ESL.

2.5.1 Shot circuit relay –KR (Option)



With the button short-circuit the output is short circuit with a power relay.



NOTE! The maximum current may not be more larger than the maximum current of the load. The maximum short-circuit power may not be larger than the maximum power of the load.



If a source is attached with more current and/or more power than the short-circuit relay and/or the load can be destroyed.

Before operation of the short-circuit the maximum current should be adjusted.



2.6 Power output

2.6.1 Output clamps

The outputs plus (+) and minus (-) are on all types on the rear panel. Screw sockets up to 300A and copper rails over 300A.

With the option –AKF you have outputs on the frontpanel. The output current is limited up to 20A. The option is standard on load ESL/EDL 100, 250 and 500

plus (+)	red socket
minus (-)	blue socket


The voltage sense terminal are only on the rear panel (screw sockets.)

0-Volt-option (Option):

The 0-Volt-option is wired on the output clamps on the rear of the unit. To operate the unit without a 0-Volt-option the output clamps on the back of the unit has to be used.

2.6.1 Output clamps on the back of the unit

Attention!



The output clamps Plus (+) and Minus (-) on the back of the unit (screw sockets) are permitted up to 50 A load current. If the current is higher use 2, 3 or more screw sockets.

The load lines may only be connected on the load clamps Plus (+) and Minus (-) and

not on the sense clamps Plus-Sense (+S) and Minus-Sense (-S).

The outputs (+) and (+S) eg. (-) and (-S) must be bridged if the sense operation is not requested !

The outputs Plus (+), Plus-Sense (+S), Minus (-) and Minus-Sense (-S) are as screw connector clamps on the back of the unit.

By delivery of the unit there are connection bridges installed on plus and plus-sense and between minus and minus sense. In the requested sense operation the bridges have to be taken off and each line has to get connected single.



2.6.2 Connection of the test item without 0V-option

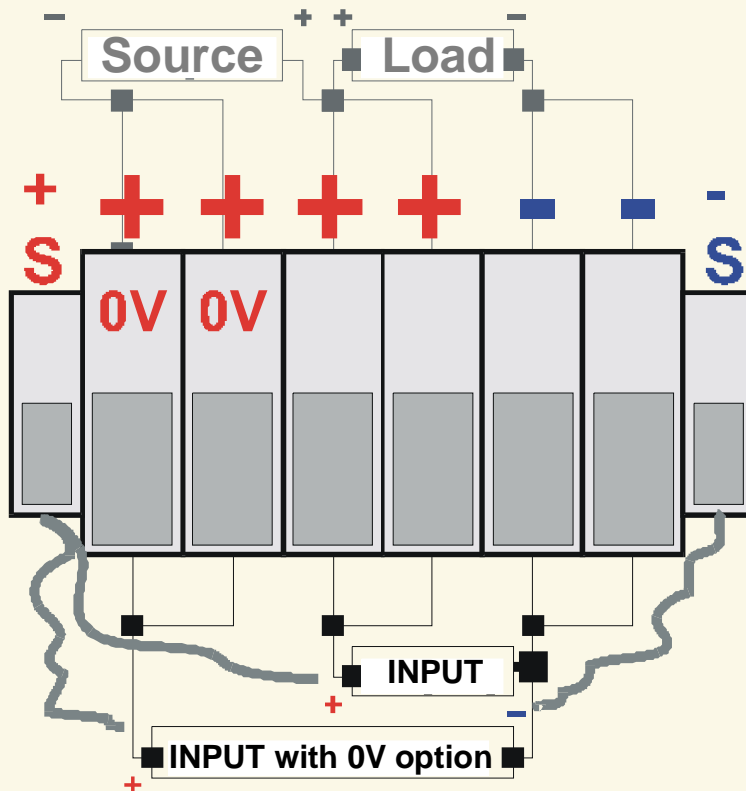
By not using the 0V-option the test item has to be connected on two clamps ' - ' and the two clamps ' + '.

The two sense sensor lines have to be connected on the clamps ' +S ' and ' -S '.

2.6.3 Connection of the test item with 0V-option

By using the 0V-option the test item has to be connected on the rear clamps to the two clamps ' - ' and the two clamps ' + 0V '.


The two sense sensor lines have to be connected on the connection clamps ' +S ' and ' -S '.






2.7 Sense operation

To avoid voltage losses on the load lines it is possible on the ESL/EDL to connect sense wires directly onto the application. For this the sense-short circuits on the terminals on the back of the unit has to be removed. The power lines for the current will be placed between the ESL/EDL Plus and the application Plus and between ESL/EDL Minus and the application minus. Parallel to this load lines thin lines between the connectors +S and the Plus of the application and -S and the Minus of the application will be connected.

	<p>The load lines may only be connected to the load clamps Plus (+) and Minus (-) and</p> <p><u>not at the sense clamps Plus-Sense (+S) and Minus-Sense (-S).</u></p> <p>The outputs (+) and (+S) or (-) and (-S) must be short circuit if the sense operation is not required !</p>
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3. Remote control by analogue interface "Interface" (Option -A)

	<p><i>There is a galvanic connection between the analogue interface and the power output !!!</i></p> <p><i>(Except with Option -AG)</i></p>
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All control in- and outputs are available on the D-SUB 25 – sockets, which are on the back of the unit.

By delivery of the unit the two D-SUB 25 – socket are short circuit on the back of the unit by a ribbon cable with two D-SUB 25 connectors.

To remote control the unit this ribbon cable can be removed and the requested external connection can be made as described below.

The analogue interface is available on the D-Sub25-socket „control input for load“. To keep single functions or indications on the front board available the requested functions can be connected between the two D-Sub 25 connectors. They are between both sockets „control input for load“ and „output front operation“ available.



3.1 Control inputs

3.1.1 Remote operation 0-5 V DC for load current

The load current can be adjusted with an extern control voltage 0 – 5 V DC and can be adjusted proportional. The control voltage plus has to be connected with Pin 9 (I-Set), control voltage-GND with Pin 3 (GND-analogue).

i. e.: Max. current = 100 A

5,0 V	Control voltage comply with	100 A output voltage
2,5 V	Control voltage comply with	50 A output voltage
1,0 V	Control voltage comply with	20 A output voltage

3.1.2 Remote operation 0-5 V DC for load resistance

The load resistance can be adjusted proportional with an extern control voltage up to 0 - 5 V DC. Control voltage plus has to be connected with pin 9 (I-SET), control voltage-GND with pin 3 (GND-analogue).

Max. current $I_{max} = 100 \text{ A}$
 Max. voltage $U_{max} = 60 \text{ V}$

$$\underline{R_{min}} = \frac{U_{max}}{10 * I_{max}} = \frac{60 \text{ V}}{10 * 100 \text{ A}} = \underline{0,06 \text{ Ohm}}$$

R = requested resistance value
 Uprog = programming voltage

R · Rmin

$$U_{prog} = \frac{U_{max}}{2 * I_{max}} * \frac{1}{R}$$

Example: R = 1 Ohm

Register in equation without units !

$$\underline{U_{prog}} = \frac{60}{2 * 100} * \frac{1}{1} = \underline{0,3 \text{ V}}$$

The programming voltage is Uprog = 0,3 V.



3.2 Remote control "STAND-BY"-Function

The "STAND-BY"-Function can be operated by TTL-signal. After switching on the unit the „STAND-BY"-Function is unactive. The output is active and after each adjustment the load current can flow.

To activate the "STAND-BY"-Function Pin 1 (Stand-By) at the analogue interface with Pin 6 (GND-Digital) has to be connected by an relais contact. The output is high ohmed until the connection to the GND-digital is separated again.

After an error „ERROR“ the unit stays „STAND-BY“. The quit appears by setting of the Stand-By-Function (connection Stand-By and GND-Digital).

3.3 Remote control I- / R-MODE-change operation mode

After switching on the unit is in the operation mode „current constant“ (CC). To switch in the operation mode “resistance constant (CR) Pin 14 (R-Mode) has to be connected onto Pin 6 (GND-digital) i.e. by an relais contact. The operation mode CR stays active until the connection to GND-digital is separated.

3.4 Control-outputs

3.4.1 Monitor-output 0-5 V DC for voltage

Proportional to the output voltage of the unit an analogue signal is available. The monitor voltage to the output voltage can be used between Pin 16 (U-Monitor, 0-5V DC) and Pin 3 (GND-Mess) .

z.B.: Max. voltage = 60 V DC

5,0 V	Monitor voltage comply with	60 V output voltage
2,5 V	Monitor voltage comply with	30 V output voltage
1,0 V	Monitor voltage comply with	12 V output voltage

3.4.2 Monitor-output 0-5 V DC for current

Proportional to the flowing load current of the unit an analogue signal is available. The monitor voltage to the load current can be used between Pin 4 (I-Monitor, 0-5 V DC) and Pin 3 (GND-Mess) .

z.B.: Max. current = 100 A

5,0 V	Monitor voltage comply with	100 A output voltage
2,5 V	Monitor voltage comply with	50 A output voltage
1,0 V	Monitor voltage comply with	20 A output voltage



3.4.3 Signal for error "ERROR"

After an error between Pin 20 (ERROR, 0 V / +5 V) and Pin 7 (GND-Digital) the error message „ERROR“ is shown.

no error	:	+5 V
error	:	0 V

After an error „ERROR“ the unit stays in the operation mode “STAND-BY”. The quitting goes by setting of the stand-by-function (connection stand-by and GND-digital). After this the stand-by function has to be set back (connection stand-by and GND-digital).

3.5 Plug holding analogue interface D-SUB 25

Pin:	Name
1	Stand-By
2	N.C.
3	GND-Mess
4	I-Monitor
5	Frequency 0...5 Vdc
6	N.C.
7	GND-Digital
8	N.C.
9	I-Stat.-Set 0...5Vdc
10	N.C.
11	N.C.
12	N.C.
13	+5V
14	R-Mode
15	N.C.
16	U-Monitor
17	N.C.
18	DutyCycle 0...5 Vdc
19	Dyn.
20	ERROR
21	N.C.
22	I-Dyn.-Set 0...5Vdc
23	N.C.
24	N.C.
25	N.C.



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4. **Protections**



Over voltage protection (OV)
Under voltage protection (UV)
Over power protection (OP)
Over temperature protection (OT)
Over current protection (OC)

5. **Cooling**

Forced fan cooling / 2 speeds.

6. **Parallel operation**

The parallel operation of two or more electronic loads is possible.



7. USB-, IEEE- and RS232- Interface (Option)

7.1 Description of the BUS ability



Following SCPI commands are available for Type ESL and EDL (blue one only with options):

*IDN?	ID
*RST	Clear unit
*CLR	Clear unit
*CLS	Reset fail
SOURce ON OFF 0 1	Load ON / OFF
SOURce?	Load ON / OFF
SOURce:CURRent v	Current (constant-I)
SOURce:CURRent ?	Current (constant-I)
SOURce:CURRent:RANGe?	Current range
SOURce:VOLTagE v	Voltage Option –CV
SOURce:VOLTagE?	Voltage Option –CV
SOURce:VOLTagE:RANGe?	Voltage range Option –CV
SOURce:RESistance v	Resistance (constant-R)
SOURce:RESistance?	Resistance (constant-R)
SOURce:RESistance:RANGe?	Resistance range
SOURce:POWer v	Power Option –CP
SOURce:POWer?	Power Option –CP
SOURce:POWer:RANGe?	Power range Option –CP
SOURce:VOLTagE:LIMit:CUToff v	Under voltage cut off Option –EUSA
SOURce:VOLTagE:LIMit:CUToff?	Under voltage cut off Option –EUSA
SOURce:VOLTagE:LIMit:RESTore v	Under voltage turn on Option –EUSA
SOURce:VOLTagE:LIMit:RESTore?	Under voltage turn on Option –EUSA
SOURce:VOLTagE:CUToff:STATe?	Under voltage? Option –EUSA
SOURce:FUNCTion:MODE CC CR CV CP	Constant-I, -R, -U, -P Option –CV, CP
SOURce:FUNCTion:MODE?	Constant-I, -R, -U, -P Option –CV, CP
SOURce:SHORT ON OFF 0 1	Shot circuit relay ON / OFF Option -KR
MEASure:CURRent?	Current measurement
MEASure:CURRent:RANGe?	Current measurement
MEASure:VOLTagE?	Voltage measurement
MEASure:VOLTagE:RANGe?	Voltage measurement
MEASure:POWer?	Power measurement
MEASure:ALL?	Measure all values at the same time
SYSTem:ERRor?	Error

v = Floating point number with one point as decimal separators.



Additional commands only for load EDL:

SOURce:TRANSient:MODE REC SIN TRI	Dynamic: Rectangle, sine , triangle Option –SD
SOURce:TRANSient:MODE?	Dynamic: Rectangle, sine , triangle Option –SD
SOURce:TRANSient:STATe ON OFF 0 1	Dynamic ON / OFF
SOURce:TRANSient:STATe?	Dynamic ON / OFF
SOURce:TRANSient:DCYCLe v	Pulse interval ratio
SOURce:TRANSient:DCYCLe?	Pulse interval ratio
SOURce:TRANSient:DCYCLe:RANGe?	Pulse interval ratio
SOURce:TRANSient:FREQuency v	Frequency
SOURce:TRANSient:FREQuency?	Frequency
SOURce:TRANSient:FREQuency:RANGe?	Frequency
SOURce:TRANSient:CURREnt v	Dynamic current
SOURce:TRANSient:CURREnt?	Dynamic current
SOURce:TRANSient:CURREnt:RANGe?	Dynamic current
SOURce:TRANSient:VOLTage v	Dynamic voltage Option –CV
SOURce:TRANSient:VOLTage?	Dynamic voltage Option –CV
SOURce:TRANSient:VOLTage:RANGe?	Dynamic voltage Option –CV
SOURce:TRANSient:RESistance v	Dynamic resistance
SOURce:TRANSient:RESistance?	Dynamic resistance
SOURce:TRANSient:RESistance:RANGe?	Dynamic resistance
SOURce:TRANSient:POWER v	Dynamic power Option –CP
SOURce:TRANSient:POWER?	Dynamic power Option –CP
SOURce:TRANSient:POWER:RANGe?	Dynamic power Option –CP

Additional commands for Multiple Load Instruments (ESL-D, EDL-D):

INSTrument:NSElect 1 2 3 4	Select internal Load 1, 2, 3, 4
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Additional commands for Load with Build-In-Sources:

OUTPut1 ON OFF 0 1	Source1 on / off
OUTPut1?	Source1 on / off
OUTPut2 ON OFF 0 1	Source2 on / off
OUTPut2?	Source2 on / off

Additional commands for Loads with Short Circuit Relay (Option KR):

SOURce:SHORT ON OFF 0 1	Short Circuit Relay on / off
-------------------------	------------------------------

v = Floating point number with one point as decimal separators.



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7.2 USB Driver and Library

To control the device via USB the USB device driver must be installed. You will be asked for the driver for the "ET1307" device when first connecting the device to the PC. The driver is on the Support CD. After installation a "ET1307" device appears in the system.

To send commands and get answers from your application, the library EBHOST.DLL can be used. The functions of the library are defined in the file EBDEF.H which can be included directly in a C or C++ Application.

First you must initialize the device with the Eblnit function. The UnitNr nUnit appears in the properties dialog of the "ET1307" device in the device manager. There exists an entry of the form "ET1307 UNR000", where the number behind "UNR" defines the unit number. In this example the unit number (UNR) is 0. The ID string can be left blank, if the ID is unknown. If nComPort is greater as 0 the com port with number is initialized for that device. If it is 0, the USB port is initialized.

```
long Eblnit(long nUnit, const char* pID, long nIDSize, long nComPort);
```

To reset the device you can use the function:

```
long EbReset(long nUnit);
```

For commands without an expected answer you can use the function:

```
long EbCommand(long nUnit, const char* pCmd, long nCmdSize);
```

The Pointer pCmd points to the string buffer of maximum 64 characters which holds the command (i. e. "SOUR:OUTP ON").

For queries with an expected answer you can use the function:

```
long EbQuery(long nUnit, const char* pCmd, long nCmdSize, char* pAnswer, long nAnswerSize);
```

The Pointer pCmd points to the string buffer of maximum 64 characters which holds the command (e.g. "MEAS:VOLT?"). The pointer pAnswer points to a string buffer of minimal 64 characters which receives the answer (e.g. the measured value).



7.2.1 Interpreter EPRET

The Interpreter EPRET.EXE uses the Library EBHOST.DLL to connect to the device. To initialize with EPRET, use the Init function without the buffer length nCmdSize:

```
Init(0,,0)           {Init Device with device number 0 via USB}
```

All commands and queries defined for that device can then be used directly to send with the EPRET Software. EPRET can also used to connect the device via RS232.

Error Handling:

```
cEbAck = 0;           // no error {device and DLL}
cEbErrGeneric = -102; // syntax error {device only}
cEbErrUnknown = -113; // undefined header (unknown command)
                       // {device only}

cEbErrRange = -222;   // out of range {device only}
cEbErrParam = -224;   // illegal parameter value {device only}
cEbErrSlot = -228;    // address error {device only}
cEbErrInstrFormat = -232; // invalid format {device and DLL}
cEbErrHw = -240       // hardware error {device only}
cEbErrHwOvp = -241    // hardware error: over voltage {device only}
cEbErrHwOt = -242     // hardware error: over temperature {device only}
cEbErrHwMod = -243    // hardware error: module not present{device only}
cEbErrTooMany = -350; // too many errors {device only}
cEbErrCom = -360;     // communication error {device and DLL}
cEbErrInstrQueue = -363; // input buffer overrun {device only}
cEbErrInstrSeq = -400; // query error {device only}

cEbErrUnit = -901;    // unit not present {DLL only}
cEbErrDllException = -910; // dll exception {DLL only}
cEbErrMemException = -911; // out of memory error {DLL only}
cEbErrFileException = -912; // file handling error {DLL only}
```



7.3 RS232- (V24-) Mode



If the control is to be via the serial interface then the USB port be unconnected. Connect the Host PC to the RS232 port via **Turn-Over-RS232** cable.

The interface parameter are fixed as follows:

Baud rate	9600 Bit/s
Data bits	8
Parity	None
Stop bits	1
Hand shake	None
Terminator	LF

You can send all commands and queries directly via RS232 port using a LF character (ASCII code 10) as termination character.

7.3.1 RS232-Connector, D-SUB 9

		9	N.C.			
CTS	8	7	RTS			
N.C.	6	5	COM (GND)			
N.C.	4	3	TxD/RxD	2	1	N.C.



7.4 Description of the IEEE488.2-BUS ability

The IEEE488.2-BUS interface was realized with NEC GPIB-Controller. The following interface functions by norms IEEE 488.2 are available :

SH1	Source Handshake	:	all functions
AH1	Acceptor Handshake	:	all functions
T6	Talker	:	basic equipment, serial-Poll, End-addressing by MLA
L4	Listener	:	basic equipment End-addressing by MLA
SR1	Service Request	:	all possibilities
RL1	Remote Local	:	all abilities (with closing LLD)
PP1	Parallel Poll	:	adjustment remote control
DC1	Device Clear	:	all abilities
DT0	Device Trigger	:	no abilities
CO	Controller	:	no abilities

The connection to the BUS happens over a 24-pol plug connection by IEEE-488.2 norm.

7.4.1 The adjustment of 6-DIP-switch

With the 6-DIP-switch beside the IEEE488 connector the operation mode of the system will be adjusted. The switch position will be asked by switching on the unit. After each changing of the switch position the unit must be switched on and off.

The following orders were required:



switch 6(MSB): OFF operation with RS232-interface
 ON operation by IEEE488.2-BUS.

The rest of the 6 DIP-switches will get IEEE adress set funtion.



7.4.2 IEEE488.2-operation

With the switches 5 to 1 the unit address on the IEEE488.2-BUS will be layed down. The address 1 to 30 is possible.

If a unvalid address is adjusted, e.g. 0 or 31, the diode is blinking. In this error case a permissible address must be adjusted. The unit must be switched on again. The unit address must be adjusted binary-coded. The valence 1 on switch 1, the valence 2 on switch 2, the valence 3 on switch 3 will be adjusted. If the switch is in position OFF, the bit has the value 1.1. In position ON the bit has the value 0.

Example.: The unit address 6 has to be set.

$$6 = 4 + 2,$$

i. e. switch 3 (value 4) and switch 2 (value 2) must be in the Off position. Switches 5, 4 and 1 are On, i.e. they have the value 0.

To simplify the settings all the permissible device addresses and associated switch positions are listed below.



The address set by the factory is: **5 (IEEE488)**



Sw 5	Sw 4	Sw 3	Sw 2	Sw 1	unit-adr.	Listener-adr.	Talker-adr.
OFF	OFF	OFF	OFF	ON	1	!	A
OFF	OFF	OFF	ON	OFF	2	"	B
OFF	OFF	OFF	ON	ON	3	#	C
OFF	OFF	ON	OFF	OFF	4	\$	D
OFF	OFF	ON	OFF	ON	5	%	E
OFF	OFF	ON	ON	OFF	6	&	F
OFF	OFF	ON	ON	ON	7	'	G
OFF	ON	OFF	OFF	OFF	8	(H
OFF	ON	OFF	OFF	ON	9)	I
OFF	ON	OFF	ON	OFF	10	*	J
OFF	ON	OFF	ON	ON	11	+	K
OFF	ON	ON	OFF	OFF	12	,	L
OFF	ON	ON	OFF	ON	13	-	M
OFF	ON	ON	ON	OFF	14	.	N
OFF	ON	ON	ON	ON	15	/	O
ON	OFF	OFF	OFF	OFF	16	0	P
ON	OFF	OFF	OFF	ON	17	1	Q
ON	OFF	OFF	ON	OFF	18	2	R
ON	OFF	OFF	ON	ON	19	3	S
ON	OFF	ON	OFF	OFF	20	4	T
ON	OFF	ON	OFF	ON	21	5	U
ON	OFF	ON	ON	OFF	22	6	V
ON	OFF	ON	ON	ON	23	7	W
ON	ON	OFF	OFF	OFF	24	8	X
ON	ON	OFF	OFF	ON	25	9	Y
ON	ON	OFF	ON	OFF	26	:	Z
ON	ON	OFF	ON	ON	27	;	[
ON	ON	ON	OFF	OFF	28	<]
ON	ON	ON	OFF	ON	29	=	^
ON	ON	ON	ON	OFF	30	>	^



7.5 Programming with SCPI commands

To control the device, you can send commands via USB or RS232 interface. To send commands via USB the library EBHOST.DLL can be used. The functions of the library can be imported by your application program. If you want to control the device via USB without writing an application you can use the interpreter software EPret.

If you want to use the RS232 port, you can send the commands directly. You can use any terminal program, the interpreter EPret or an own application.

All values can be transferred as string representing a floating point value. The commands can be transferred as string that is not case sensitive.

E.G. you can transfer the command
SOURce ON|OFF|0|1

By using the following strings
SOURCE ON
SOUR 1
sour on

As terminator sign for the RS232 communication the ASCII-character <LF> (ASCII-Code 10) must be used.

Switch On and Off

To switch on the load the following command can be used:

SOUR ON

To switch off the load the following command can be used:

SOUR OFF

The switch off command can also be used to reset an error of the device.



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7.5.1 Constant Current Mode CC

To activate the constant current mode the following command can be used:

```
SOURce:FUNCtion:MODE CC
```

This is also the mode after power on the device.

To read back the activated mode the following query can be used:

```
SOURce:FUNCtion:MODE ?
```

7.5.1.1 Set a current value

To set a current value the following command can be used:

```
SOURce:CURREnt v
```

To read back the set value of the current the following command can be used:

```
SOURce:CURREnt?
```

To read back the maximum set value of the current the following command can be used:

```
SOURce:CURREnt:RANGe?
```

<p><u>Attention:</u> After activating the bus communication the load is switched off. To switch on the load you can use the command SOUR ON.</p>



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7.5.2 Constant Resistance Mode CR

To activate the constant resistance mode the following command can be used:

```
SOURce:FUNCtion:MODE CR
```

To read back the activated mode the following query can be used:

```
SOURce:FUNCtion:MODE ?
```

7.5.1.1 Set a resistance value

To set a resistance value the following command can be used:

```
SOURce: RESistance v
```

To read back the set value of the resistance the following command can be used:

```
SOURce: RESistance?
```

The minimum set value of the resistance can be calculated as follows:

$$R_{\min} = U_{\max} / (10 * I_{\max})$$

Every value higher than R_{\min} can be set.

The minimum set value of the resistance can also be read back:

```
SOURce:RESistance:RANGe?
```



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7.5.3 Constant Voltage Mode CV (Option)

7.5.3.1 Setting

7.5.3.1.1 Constant Voltage Mode

To activate the constant voltage mode the following command can be used:

```
SOURce:FUNCtion:MODE CU
```

7.5.3.1.2 Set voltage

To set a voltage value the following command can be used:

```
SOURce:VOLTage v
```

To read back the set value of the voltage the following command can be used:

```
SOURce:VOLTage?
```

To read back the maximum set value of the voltage the following command can be used:

```
SOURce:VOLTage:RANGe?
```



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7.5.4 Constant Power Mode CP (Option)

7.5.4.1 Setting

7.5.4.1.1 Constant Power Mode

To activate the constant power mode the following command can be used:

```
SOURce:FUNCtion:MODE CP
```

7.5.4.1.2 Set power

To set a power value the following command can be used:

```
SOURce: POWER v
```

To read back the set value of the power the following command can be used:

```
SOURce: POWER?
```

To read back the maximum set value of the power the following command can be used:

```
SOURce: POWER:RANGE?
```



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7.5.5 Dynamic Modes (EDL only)

7.5.5.1 Setting

7.5.5.2 Dynamic Mode

The Dynamic Mode can be used in the Constant Current Mode only.

To activate the dynamic mode the following two commands must be send sequentially:

```
SOURce:TRANSient:MODE REC
SOURce:TRANSient:STATE ON
```

With that commands the load will be set to dynamic mode with recangle pulses.

7.5.6 Current Setting

To set the minimum current value the following command can be used:

```
SOURce:CURRent v
(e.g.: 0,1A ==> SOURce:CURRent 0.1)
```

To set the maximum current value the following command can be used:

```
SOURce:TRANSient:CURRent v
(e.g.: 1A ==> SOURce:TRANSient:CURRent 1)
```

The rectangle waveform forces the current to change between these two values.

The frequency can be set in the range 1...2000 Hz with the following command:

```
SOURce:TRANSient:FREQency v
(e.g.: 100Hz ==> SOURce:TRANSient:FREQency 100)
```

The pulse width relationship can be set with the following command:

```
SOURce:TRANSient:DCYClE v
(e.g.: 10 ==> SOURce:TRANSient:DCYClE 10)
```

10 = 10 % Pulse with maximum current
90 = 90 % Pulse with maximum current

The possible range is 10 ... 90, that means 10...90 %.



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7.5.7 Undervoltage Cut Off – EUSA (Option ESL only)

With this option the cut off in an undervoltage condition can be set in the range 1V to maximum voltage.

UV Cut Off limit:

SOURce:VOLTage:LIMit:CUToff v

UV Cut Off Restore Voltage:

SOURce:VOLTage:LIMit:RESTore v

Query of Cut Off state:

SOURce:VOLTage:CUToff:STAtE?

The restore voltage always must be greater than the limit. If you set higher currents, the difference between restore voltage and limit should higher also.

7.6 Measure Functions

To measure the voltage the following command can be used:

MEASure:VOLTage?

To measure the current the following command can be used:

MEASure:CURREnt?



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7.7 Build-In-Sources

If the load has sources build in, the sources can be switch on or off with the following commands:

Switch On:

OUTPut1 ON

OUTPut2 ON

Switch Off:

OUTPut1 OFF

OUTPut2 OFF

7.8 Multiple Load Instruments (ESL-D, EDL-D)

If the devices has more than one load build (e.g. Dual-Load ESL-D, EDL-D), the different internal loads can be selected with the following command:

```
INSTrument:NSElect 1|2|3|4
```

The maximum number depends on the count of loads build in. If a selection is made, all following commands send will be affect the selected load only.

The selected load can be read back with the following query:

```
INSTrument:NSElect?
```

7.9 Short Circuit Relay (Option KR)

To short the input clamps of the load the following command can be used:

```
SOURce:SHORT ON|OFF|0|1
```

Before shorten the input, the maximum current should be set.



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7.10 Error

A device error can be read back with the following query:

```
SYSTEM:ERRor?
```

The errors will be send back from the device in the sequence of they occur.

7.11 Device ID

The device ID can be read back with the following query:

```
*IDN?
```

7.12 Device Reset

To reset the device to power on state the following command can be used:

```
*RST  
*CLS
```

To reset the error memory the following command can be used:

```
*CLS
```



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8.0 Appendix specification