

Operating instructions

E 8147.20

**Reference Impulse Calibrator RIC422
Version 1.0**

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1 General

These operating instructions contain the information required to use the instrument. Please read the instructions before operating the instrument, and observe the specifications and suggestions exactly. Emil Haefely & Cie AG waives all liability for personal, material, or consequential damage resulting from improper use of the instrument.

The technical specifications are summarized in the attached publication.

2 Principle of operation

The impulse calibrator consists of a conventional high-precision impulse circuit with a semiconductor switch. The charge capacitor is charged by an adjustable, highly stable source.

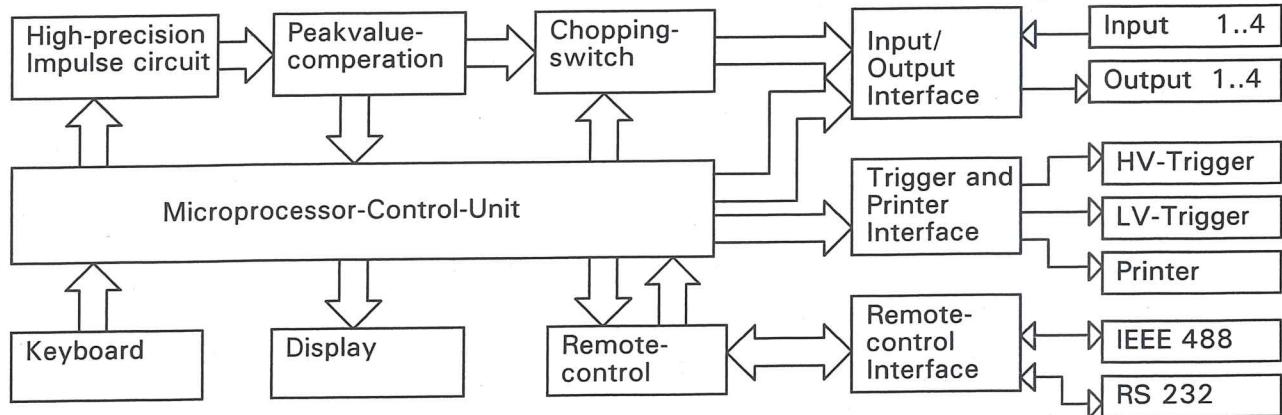
The maximum value is compared with the reference value. The charging voltage of the impulse circuit is varied until the maximum impulse value matches the desired value.

For chopped impulses, the impulses are short-circuited using a semiconductor switch. The input/output interface is installed for multichannel instruments only, and allows automatic output switching.

A microprocessor controls the instrument using the control panel and display.

Multichannel instruments are equipped with a remote-control interface. Additional inputs are provided for HV and LV triggers and a printer.

2.1 Block diagram



2.2 Output signals

The following signals can be generated using the instrument: lightning impulse, lightning impulse (front chopped), switching impulse, step function, and DC voltage.

2.2.1 Lightning impulse

The curve shape is generated by a high-precision impulse circuit. All time parameters are fixed. The maximum value is adjustable in 1 V steps between 80 V and 1600 V. It is always calibrated and checked before the impulse is generated.

The lightning impulse is specified using standard IEC60.1. The following values are guaranteed:

Front time T1	0.84 us \pm 2.0% ¹⁾	0.2% ²⁾
Decay time T2	60 us \pm 2.0% ¹⁾	0.2% ²⁾
Maximum value \hat{U}	$\pm 80V \dots 1600 V \pm 0.5\%$ ¹⁾	0.1% ²⁾

- 1) Maximum deviation of average value of a 20-impulse sequence from reference value
 2) Maximum standard deviation of a 20-impulse sequence

2.2.2 Lightning impulse (front chopped)

The curve shape is generated by a high-precision impulse circuit, with the lightning impulse being short-circuited after 0.50 ms by a semiconductor switch. All time parameters are fixed. The maximum value is adjustable in 1 V steps between 400 V and 1250 V. It is always calibrated and verified before the impulse is generated.

The chopped lightning impulse is specified by standard IEC60.1. The following values are guaranteed:

Chopping time Tc	0.50 us \pm 2.0% ¹⁾	1.0% ²⁾
Maximum value \hat{U}	$\pm 400V \dots 1250 V \pm 1.0\%$ ¹⁾	0.2% ²⁾

- 1) Maximum deviation of average of a 20-impulse sequence from the reference value
 2) Maximum standard deviation of a 20-impulse sequence

2.2.3 Switching impulse

The curve shape is generated by a high-precision impulse circuit. All time parameters are fixed. The maximum value is adjustable in 1 V steps between 80 V and 1600 V. It is always calibrated and verified before the impulse is generated.

The switching impulse is specified by standard IEC60.1. The following values are guaranteed:

Maximum value Tp	20 us \pm 2.0% ¹⁾	0.2% ²⁾
Decay time T2	4000 us \pm 2.0% ¹⁾	0.2% ²⁾
Maximum value \hat{U}	$\pm 80V \dots 1600 V \pm 0.5\%$ ¹⁾	0.1% ²⁾

- 1) Maximum deviation of average value of a 20-impulse sequence from the reference value
 2) Maximum standard deviation of a 20-impulse sequence

2.2.4 Step function

The step function is generated by short-circuiting a DC voltage using a semiconductor switch. As a result, the negative slope is available as a step function. The step function is repeated periodically with a repetition rate of approximately 100 ms. The voltage value is adjustable in 1 V steps between +1000 V and +2000 V.

The following values are guaranteed for the step function:

Bise time (U to 0 V) <20 ns

¹⁾ ± 1000 V ²⁾ ± 2000 V ¹⁾ ± 1.0% ²⁾ 0.2%

1) Maximum deviation of the average value of a 20-impulse sequence from the reference value.

2) Maximum deviation of a 20-impulse sequence

2.2.5 DC voltage

DC Voltage
The DC voltage is generated by the internal high-voltage source. Only positive voltages can be generated. The DC value can be adjusted in 1 V steps between +200 V and +2000 V.

The following values are guaranteed:

The following values are guaranteed:

1) Maximum deviation of DC voltage from the reference value

2.2.6 Load conditions

The instrument is calibrated with a load condition of 250kOhm/200pF. The given accuracy is guaranteed for the following load range :

Load range $\geq 250\text{k}\Omega/\text{pF}$... $\geq 250\text{k}\Omega/300\text{pF}$

The load values are specified without LEMO-connectors. Pay attention to the fact that the output configuration represents a base load :

Instrument grounded: 4 channel version : 35 pF straycapacitance plus
35pF / active output

1 channel version : 35pF straycapacitance

To guarantee the calibrated operation of the instrument, the effective length of the fiber must be known.

To guarantee the calibrated operation of the instrument, the connection cable (optional, DUT) should be checked.

2.2.7 Operating conditions

The impulse calibrator can be operated under following conditions :
5-8°C - 40-8°C (Operating range)

5 °C...40 °C
20 °C...35 °C

20 °C...25 °C (Reference mode)
25%...80% L (Non-condensing)

35% ...80% rh (Non-condensing)

To guarantee the specified accuracy, a warm-up-time of 30 minutes is essential.

2.3 Printer interface

A printer interface is provided on the rear of the instrument for connecting a printer (see publication). Use a Haefely printer for reports (to order, see publication).

2.4 Remote control

The impulse calibrator (4 channel version) can be remote-controlled through the interfaces (IEEE488 or RS232). Only one interface is active at a given time. The interfaces are located on the rear of the instrument.

The interface is configured using the configuration menu (see Section 3.8). All functions and parameters adjustable through the keyboard are also adjustable through the remote control channel. The data are transmitted as 7 bit ASCII characters.

If the impulse calibrator is remote-controlled, the instrument switches to the REMOTE mode. The instrument keyboard is inactive in this mode.

2.4.1 IEEE488

According to standard IEEE488 (or IEC625), the interface is characterized by the following capabilities:

Handshake-source-function	SH1	Full capability
Handshake-sink-function	AH1	Full capability
Speaker function	T5	Basic version of speaker; serial inquiry; tone always incorrect; de-addressing with MLA
Listener function	L3	Basic version of listener; tone always incorrect; de-addressing with MTA
Operator call function	SR1	Full capability
Remote/local select function	RL2	No control with interlock
Parallel query function	PPO	No capability
Reset function	DCO	No capability
Triggering function	DTO	No capability
Controller function	CO	No capability

For addressing as speaker or listener, bus addresses MTA (My Talk Address) and MLA (My Listen Address) are adjustable in a range from 0 to 30, where MTA and MLA are the same. Secondary addresses are disregarded.

Data are transmitted as 7 bit ASCII characters. Acceptable block end characters are CR (Carriage Return), LF (Line Feed), and EOI, together with the last character transmitted.

2.4.2 RS232

The serial interface uses the two data lines TxD and RxD for information exchange. Handshake capabilities include hardware protocol RTS/CTS and software protocol XON/XOFF.

2.4.3 Command syntax

Separators

The following separators are used within a command and to separate commands or to terminate a command block:

< >	Space) after the instruction header
<;>	Termination of a command segment within a block
<EOS>	Termination of a command block by a programmable end of sequence condition

Character Formats

Integers: positive numbers in the range from 0 to 29999, transmitted as an ASCII string. The segment and format are the same as for input/output via the display.

Character Strings

Setting commands

Setting commands consist of the following three elements:

<set command> = <header>< ><argument>

<header> Series of 2 to 4 ASCII characters from A to Z; a to z as identification of the command. No distinction is made between upper and lower case letters.

< > Separator between <header> and <argument>.

<argument> Argument, in the form of an integer number or a character string. No distinction is made in character strings between upper and lower case letters.

Several setting commands may be combined into one command, terminated by the separator <EOS>. Individual commands are then separated from one another by a semicolon:

<set command> {;<set command>}<EOS>

Query commands

Query commands cause the pulse calibrator to transmit internal data to the system controller. They consist of only two parts:

<query command> = <header>{< >}<?>

In a query command, a question mark is used instead of the argument. A command may contain a maximum of one query, which must come at the end of the command. On the other hand, several setting commands may precede the query.

Remote control debug utility

The remote control debug utility is used to test the interface and user program of the host computer. The command DEB ON<EOS> switches on the debug mode. Then a series of possible error messages appears on the display, as well as the contents of the read buffer.

input buffer ovfl	Overflow of read buffer (> 100 characters)
timeout occurred	Timeout during receive
header >4 characters	Head larger than 4 characters
option required	Option missing for this command
unknown header	Unknown command
invalid argument	Wrong argument
timeout while talk	Timeout during send (handshake error)
no query here	No query during this command
query expected	Query expected
not valid in local	Command not allowed in local mode
not valid while run	Command allowed only in standby mode

DEB OFF<EOS> switches off the debug mode.

2.4.4 Instruction set

ERR (ERRor query) command

The internal error code of the impulse calibrator can be evaluated by the query ERR ? according to the table below:

Code	Description
0	No error
1	Command valid only in remote mode
2	Unknown command
3	Invalid argument
4	No query allowed
5	Command allowed in standby mode only
8	Timeout during send (handshake problem)
16	Parity error during RS232C transmission
32	Input buffer overflow
64	Other errors
Error Codes 1 to 5 always refer to the previous command. The error code is reset after each query.	

Command GTL (Go To Local)

This command is used to leave the remote control mode and activate local control via the keyboard.

Command ID (Identification)

The identification command (query only) returns the device ID:
RIC 422 1.00

Command REN (Remote ENable)

This command terminates local control via the keyboard and changes to the remote-control mode.

Command SP (Serial Poll)

The status byte of the pulse calibrator can be read using the command SP (e.g. within a serial query of all instruments).

The individual bits have the following meanings:

Bit 3	Local mode
Bit 4	Transmission error
Bit 5	Command error
Bit 6	Run mode
Bits 4 and 5 are reset by the command ERR?.	

Command STOP

Stops the generator. (Analogous to START/STOP key)

Command STRT (STaRT)

Starts the generator. (Analogous to START/STOP key)

Command STAT (STATus)

The command STAT (query only) queries the pulse calibrator status:

STBY	Generator in standby mode
BUSY	Generator in calibration mode
CAL	Generator in run mode. Amplitude calibrated.
LCAL	Generator in run mode. Amplitude calibrated on load.

Command TMO (TiMe Out)

The timeout can be set during send by the command TMO. Argument: Integer 0 to 9

2.4.5 Command list

Command	Brief description						Type of argument	
		Enable in run mode						
		Setting allowed						
		Query allowed						
Enable in local mode								
SHP	Impulse shape	-	x	x	-	LI,LC,SI,ST,DC		
LIA	LI-Full peak voltage	-	x	x	-	Integer		
LIP	LI-Full polarity	-	x	x	-	Pos,Neg		
LICA	LI-Chop peak voltage	-	x	x	-	Integer		
LICP	LI-Chop polarity	-	x	x	-	Pos,Neg		
SIA	SI peak voltage	-	x	x	-	Integer		
SIP	SI polarity	-	x	x	-	Pos,Neg		
DCA	DC voltage	-	x	x	-	Integer		
STA	Step amplitude	-	x	x	-	Integer		
MODE	RIC mode	-	x	x	-	SIN,REC,SEQ		
NBRI	Number of impulses	-	x	x	-	Integer		
INVL	Interval	-	x	x	-	Integer		
OUT1	Output CH1	-	x	x	x	On,Off		
OUT2	Output CH2	-	x	x	x	On,Off		
OUT3	Output CH3	-	x	x	x	On,Off		
OUT4	Output CH4	-	x	x	x	On,Off		
TR	Initiate trigger	-	-	x	x	-		
CAL	Initiate calibration on load	-	-	x	x	-		
STOP	Stop	-	-	x	x	-		
STRT	Start	-	-	x	-	-		
ID	Identify system, version	x	x	-	x	-		
REN	Go to remote mode	x	-	x	-	-		
GTL	Go to local mode	-	-	x	-	-		
DEB	Remote rontrol debug utility	-	x	x	-	On,Off		
SP	Serial poll (byte)	-	x	-	x	-		
ERR	Get error code (byte)	x	x	-	x	-		
EMSG	Get error message (byte)	x	x	-	x	-		
STAT	Actual status (STBY,BUSY,CAL,LCAL)	-	x	-	x	-		
TMO	Talking timeout	x	x	x	-	Integer		

3 Controls

3.1 Control panel

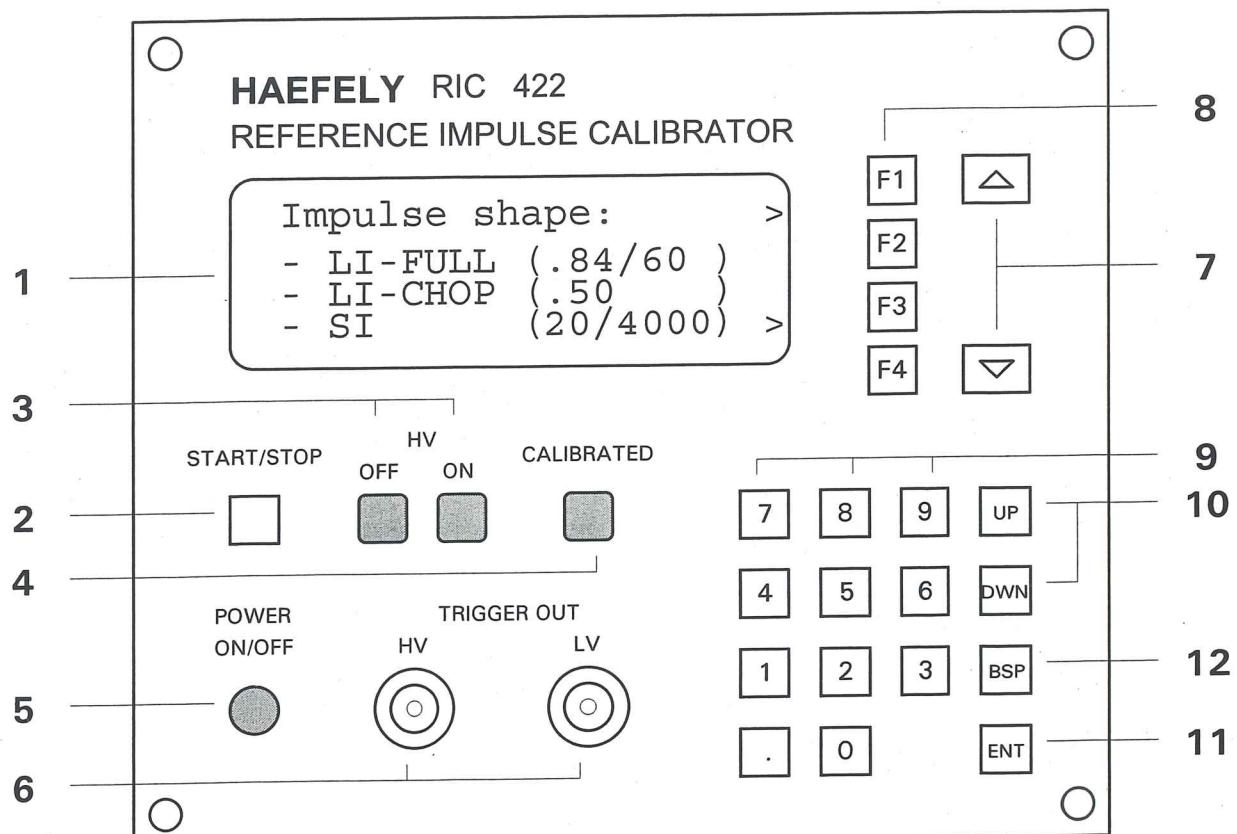


Figure 3.1: Control panel

1 LCD display: 20 characters/4 lines

Each line is assigned to a function key. The last character in lines 1 and 4 is reserved for the > symbol. It indicates that there are additional pages. These additional pages can be displayed with the page select key (7). Values that can be changed are indicated by the cursor.

2 Start/stop key

The high-voltage source is switched on and off and the generation of the selected impulses is started or interrupted. The message "Press start" in Line 4 of LCD display (1) signals that the start key is active and the high voltage can be switched on.

3 Signal lamps HV ON/OFF

These signal lamps indicate whether high voltage is present at the outputs. HV OFF (green) lights when high voltage is not applied; HV ON (red) lights when high voltage is applied to the outputs.

4 Signal lamp CALIBRATED

This signal lamp indicates whether the pulses have been calibrated on the load. When the lamp is on, it indicates that the pulse has been calibrated on the load; when it is off, the pulse has been calibrated internally (without the load).

5 Line switch

The power is switched on or off.

6 Trigger outputs

Outputs for external triggering. HV trigger: + 150 V. LV trigger: + 15 V.

7 Page selection

Displays the next page in the menu when the symbol ">" is visible in the first or last line of the display.

8 Function key

Function keys F1-F4 activate the function described in lines 1 to 4 or permit input of a value in the line selected.

9 Numerical keypad

Input of numerical values. Input is possible only when indicated by the cursor.
Numerical input is started by F1-F4 and completed with the Enter key.

10 UP/DOWN key

This key is used for continuous increase or decrease of an activated value. It can also be used to change activated, non-numerical values (POS/NEG).

11 Enter key

This key accepts the displayed values.

12 Backspace key

This key moves the cursor one space to the left. The key is used to correct values and is only active when the cursor is active.

3.2 Startup

After startup, the display shown in figure 3.2 is visible. The version of the control software is displayed. Use key F4 to start the impulse calibrator. The impulse calibrator then advances to menu page 1 with the pulse calibration/configuration.

Page	Display	Activated by	Adjustment/action
0	Impulse calibrator RIC422 Version 1.XX TO CONTINUE PRESS F4	F4	Goes to page 1

Figure 3.2: Display after startup

3.3 Impulse selection/calibration

4-channel version, the output can also be configured.

The page-select keys are used to switch between the various pages.

Pages 1 and 2 allow the impulse shape to be selected. The impulse shapes are selected by pressing the corresponding function key. The menu is then continued on pages 10 to 14. The parameters of the impulses can be set on these pages.

Page 3 allows the impulse sequences to be set. Single impulses, recurrent impulses, and impulse sequences may be selected. For the impulse sequence mode, the number and repetition interval can also be selected on Page 3. In the single-impulse mode, individual impulses are triggered by pressing the key. In the recurrent impulse mode, impulses are triggered continuously, while in the impulse sequence mode a series of impulses is triggered with a repetition interval that depends on the setting.

Page 4 permits configuration of the outputs in the 4-channel version. Each output can be switched on or off individually. In the single-channel version, this adjustment has no effect.

Page	Display	Activated by	Adjustment/action
1	Impulse shape: > - LI-FULL (.84/60) - LI-Chop (.50) - SI (20/4000)>	F2 F3 F4	Goes to page 10 Goes to page 11 Goes to page 12
2	Impulse shape: > - STEP (10 Hz) - DC >	F2 F3	Goes to page 13 Goes to page 14
3	MODE: SINGLE > NBR.OF IMPULSES 20 INTERVAL 15sec>	F1 F3 F4	Single/recurrent/ sequence 1..999 1 to 999
4	OUTPUT 1 : OFF> OUTPUT 2 : OFF OUTPUT 3 : OFF OUTPUT 4 : OFF>	F1 F2 F3 F4	ON/OFF ON/OFF ON/OFF ON/OFF

Figure 3.3: Impulse selection/configuration

3.4 Parameter setting

Pages 10 to 14 are used to set the impulse parameters. The maximum value and polarity for the lightning impulse and switching impulse can be set. The output voltage for the step function and the DC voltage can be adjusted.

Pressing the page-select keys advances to Pages 1 and 2.

The impulse parameters are set by pressing keys F2 or F3, then entering the value using the keypad or pressing the UP or DOWN keys. The value is entered by pressing the Enter key. Keys F1-F4 do not change the parameters in the change mode.

Pressing the start/stop key begins generation of the impulses and advances to menu pages 20 to 24.

Page	Display	Activated by	Adjustment/action
10	LI-Full: > PEAK VOLTAGE: 80V POLARITY : POS Press start >	F2 F3 Start/Stop	80 to 1600 V POS/NEG Goes to page 20
11	LI-Chopped: > PEAK VOLTAGE: 400V POLARITY : POS Press start >	F2 F3 Start/Stop	400 to 1250 V POS/NEG Goes to page 21
12	SI: > PEAK VOLTAGE: 80V POLARITY : POS Press start >	F2 F3 Start/Stop	80 to 1600 V POS/NEG Goes to page 22
13	Step: > AMPLITUDE : 1000V Press start >	F2 Start/Stop	1000 to 2000 V Goes to page 23
14	DC: > VOLTAGE : 200V Press start >	F2 Start/Stop	200 to 2000 V Goes to page 24

Figure 3.4: Setting impulse parameters

3.5 Generating impulses

Menu pages 20 to 24 allow impulses to be generated according to the setting. Line 1 shows the impulse shape, polarity, and amplitude. For lightning impulses and switching impulses, line 2 shows the result of calibration impulses (+: amplitude > reference value, -: amplitude < reference value). Ten impulses are generated and evaluated per calibration.

For lightning impulses and switching impulses, the display differs in terms of the impulse sequence selected.

Pressing the page-select key advances to menu page 30.

Pressing the start/stop key interrupts impulse generation. Then the system advances to menu pages 10 to 14.

3.5.1 Generation of individual pulses

Calibration of amplitude without load takes place automatically after selection of the impulse shape. Key F3 can be used to calibrate the amplitude at any time, taking the connected load into account. Individual lightning and switching impulses can be generated by pressing key F4.

No calibration is performed for the step function or the DC voltage. When menu pages 23 or 34 are displayed, the set signal is applied to the output.

Page	Display	Activated by	Adjustment/action
20	LI-Full: + 80 V > >< CAL. ON LOAD F3: TRIGGER IMPULSE F4:>	F3 F4	Calibrates impulses on load Triggers impulses
21	LI-Chopped: + 400 V > >< CAL. ON LOAD F3: TRIGGER IMPULSE F4:>	F3 F4	Calibrates impulses on load Triggers impulses
22	SI: + 80 V > >< CAL. ON LOAD F3: TRIGGER IMPULSE F4:>	F3 F4	Calibrates impulses on load Triggers impulses
23	Step: + 1000 V > >		
24	DC: + 200 V > >		

Figure 3.5: Generation of single impulses

3.5.2 Generating recurrent impulses

When recurrent impulses are selected, the amplitude is calibrated automatically after selecting the impulse shape. After calibration (indicated in line 2 of the display), impulse generation begins. The number of impulses generated is displayed at the end of line 4.

Generation of recurrent impulses can be terminated by pressing the start/stop key.

Page	Display	Activated by	Adjustment/action
20	LI-Full: + 80 V > > < Recurrent 1 >		
21	LI-Chopped: + 400 V > > < Recurrent 1 >		
22	SI: + 80 V > > < Recurrent 1 >		

Figure 3.6: Generation of recurrent impulses

3.5.3 Generation of impulse sequences

In choosing impulse sequences, the amplitude is calibrated automatically after selecting the impulse shape. Following calibration (signaled in line 2 of the display), generation of impulses begins. The number of impulses generated and the total number of pulses to be generated are displayed at the end of line 4. Line 3 signals that the interval between two impulses has elapsed. The impulse sequence is terminated on reaching the set number of impulses.

The impulse sequence can be terminated by pressing the start/stop key.

Page	Display	Activated by	Adjustment/action
20	LI-Full: + 80 V > > < Interval Sequence 1/20 >		
21	LI-Chopped: + 400 V > > < Interval Sequence 1/20 >		
22	SI: + 80 V > > < Interval Sequence 1/20 >		

Figure 3.7: Generating impulse sequences

3.6 Data logging

Menu page 30 permits the generated impulses to be logged. This menu page is selected by pressing the page select keys in menu pages 20 to 24. Press page-select keys again to leave menu page 30.

Page	Display	Activated by	Adjustment/action
30	PRINT DATA F1:> NEW PAGE F2: >	F1 F2	Prints out data Advances paper to new page

Figure 3.7: Data logging

3.7 Error messages

Error messages are listed below. If an error cannot be corrected as indicated, contact customer service or your national representative.

Error	Display	Meaning	Action
1	Printer not ready PRESS ANY KEY	Printer will not print.	Correct printer problem and press any key.
2	Generator fatal error PRESS ANY KEY	Amplitude calibration was unsuccessful.	Press any key. If problem recurs, contact customer service.
3	Invalid system configuration SYSTEM:		
4	Required option not implemented PRESS ANY KEY	Remote control interface not implemented.	Press any key.

Figure 3.8: Error messages

3.8 Configuration

The configuration menu is activated by pressing an additional function key when switching on the instrument. Menu page 100 then appears.

This menu page is used to adjust the configuration of the instrument. Function key F2 resets all instrument parameters to their default values. The respective default values are entered on the corresponding menu pages in the operating instructions.

Function key F3 allows the interface to be configured for remote control on menu pages 110 to 113.

Function key F4 starts the instrument with menu page 0 (standard menu when starting). The configuration is not changed as a result.

Page	Display	Activated by	Adjustment/action
100	System service menu GENERAL RESET F2 REM.CONTROL SETUP F3 CONTINUE PROGRAM F4	F2 F3 F4	Load default values Goes to Page 110 Goes to Page 0

Figure 3.9: Configuration

3.8.1 Remote control interface

Menu pages 110 to 113 allow the interface to be configured for remote control.

Menu page 111 appears in IEEE488 and menu pages 112 and 113 appear in RS232C. Pressing function key F4 on menu page 110 stores the modified configuration and restarts the instrument.

Page	Display	Activated by	Adjustment/action
110	REMOTE CONTROL SETUP MENU INTERFACE IEEE 488 LOAD SETUP PRESS F4>	F3 F4	IEEE488/RS232C Stores configuration
111	BUS ADDRESS 10> EOS CR+LF	F1 F2	00 ..30 CR/LF/CR + LF/EOI/EOI + LF
112	BAUD RATE 19200> DATABIT 8 STOPBIT 1 PARITY NONE>	F1 F2 F3 F4	1200...19200 7/8 1/2 None/Even/Odd
113	PROTOCOL NONE> EOS CR+LF	F1 F2	None/RTS CTS/XON XOFF CR/LF/CR + LF/EOI/EOI + LF

Figure 3.9: Configuration of remote control interface

4 Maintenance

The impulse calibrator is a highly precise instrument and must be handled with care. NEVER open the instrument.

To make sure the instrument conforms to specifications, it must be calibrated at least every two years. This can be done by Haefely or by an authorized national calibration facility (for example, PTB in Braunschweig, Germany).

5 Safety

The line cord supplied provides a connection between a protective ground and the housing of the impulse calibrator. Use only sockets with a reliable ground contact. This makes the instrument always safe to touch.

Never operate the instrument without all the front panels and covers in place.

Remember that the impulse calibrator generates voltages up to 1600 V. Avoid touching the internal conductor of the output. Use only the measuring cable supplied with the instrument.

6 Installation

The impulse calibrator requires no extensive installation and is shipped ready to use.

6.1 Unpacking instrument

When unpacking the instrument, check to be sure all the items on the packing list have been shipped and have not been damaged in transit. The instrument requires no special installation.

6.2 Power requirements

Connect the instrument to the line using the power cord supplied. The instrument can then be switched on, and the basic functions tested immediately (see "Operation"). The following should be tested: impulse generation of LI, SI; positive and negative at voltages of 80, 500, 1000, and 1600 V; LI-chopped, positiv and negative at 400 and 1250V . If these functions pass the tests, there is no internal shipping damage. The output signals need not be measured; they will be checked by the impulse calibrator.

6.3 Connection to measuring unit

Connect instrument to measuring unit using measuring cable supplied.

6.4 Printer interface

Connect printer (to order, see publication) to impulse calibrator using measuring cable supplied. Follow directions for installing printer.

6.5 Remote control interface

Connect instrument to host computer using connecting cable supplied (RS232 or IEEE488). Configure remote control interface as described in "Operation".

7 Appendix

7.1 Publication

E 147.20