Field bus specification

Version FMB V90 2.0

Data structure description of the field bus interface to communicate with Pulse Reverse Power Supplies from plating electronic GmbH

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Content:

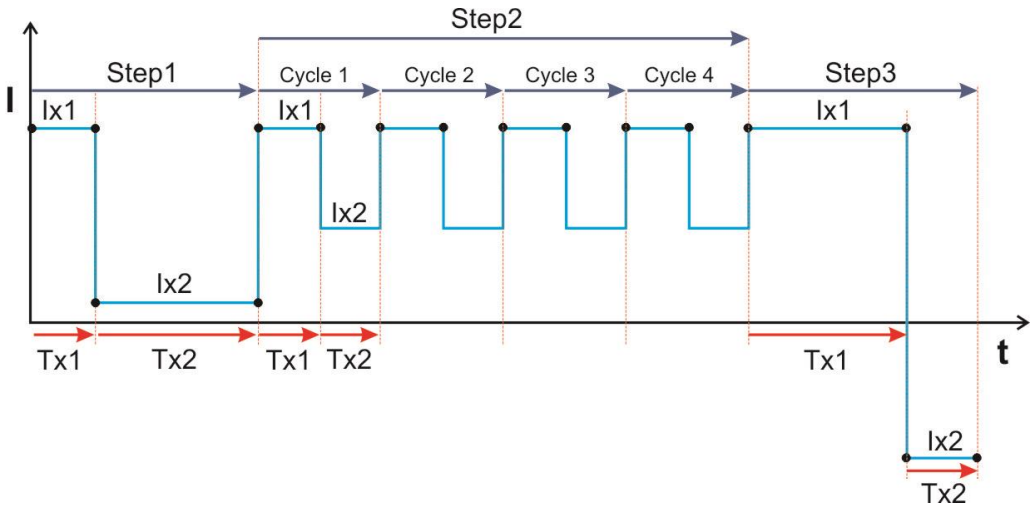
1 Basic construction of waveforms

For the pe Pulse Reverse Power Supplies was a very simple basic construction for waveforms developed, this allows the user to construct very complex waveforms in a simple and fast way:

Definition waveform:
A waveform can consist out of 1 to 16 steps with a maximum period time over all steps of 40000ms. The max. number of cycles within a waveform is limited to 500.

Definition step:
One step consists out of two current values (current 1(Ix1) and current 2(Ix2)), two time values (time for current 1(Tx1) and time for current 2(Tx2)) and a value of repetitions of the step (Cycle).

Waveform example with 3 steps:



2 General interface information

The PROFIBUS / PROFINET control of Pulse Reverse Power Supplies from plating electronic GmbH is made by an Anybus® Communicator™ from the company HMS, it operates as a gateway.
Therefore the following products are used:

PROFINET IO:
Anybus® Communicator™
Article#:AB7013

PROFIBUS:
Anybus® Communicator™
Article#:AB7000

DeviceNet:
Anybus® Communicator™
Article#:AB7001

EtherNet/IP:
Anybus® Communicator™
Article#:AB7007

The Anybus® Communicator™ module will be delivered completely configured by plating electronic

3 Fieldbus structure

3.1 Output bytes

Signal name	Byte	Bit	Signal type	Description	Value range	Unit
Data PRPS 1	**0-19**	**Data for PRPS 1**				
Status	**0-1**		**Byte**	**Status**		
Reserve	0	0-7	DO	Reserve	0…1	-
Operating status	1	0	DO	Operating status 0 = OFF 1 = ON	0…1	-
Error acknowledge	1	1	DO	Error acknowledge 0 = Idle state 1 = Error acknowledge	0…1	-
As counter reset	1	2	DO	As counter reset 0 = Idle state 1 = As counter reset	0…1	-
Sync before	1	3	DO	Sync before 0 = Idle state 1 = Sync before	0…1	-
Reserve	1	4-6	DO	Reserve	0…1	-
Accept on change	1	7	DO	Accept on change	0…1	-
Percentage set point regulator	2-3		DOWORD	Percentage set point regulator 0.00% - 100.00%	0h … 2710h	depending on device
Waveform for step X PRPS 1	**4-19**	**Waveform for step X PRPS 1**				
Current 1 (Ix1)	4-5		DOWORD	Current 1 step X (Ix1) Value range: -3276.8 to+3276.7	0h…FFFFh	A
Current 2 (Ix 2)	6-7		DOWORD	Current 2 step X (Ix2) Value range: -3276.8 to+3276.7	0h…FFFFh	A
Voltage 1 (Ux1)	8-9		DOWORD	Voltage 1 step X (Ux1) Value range: -3276.8 to+3276.7	0h…FFFFh	V
Voltage 2 (Ux2)	10-11		DOWORD	Voltage 2 step X (Ux2) Value range: -3276.8 to+3276.7	0h…FFFFh	V
Time 1 (Tx1)	12-13		DOWORD	Time for current 1 step X (Tx1) Value range: 0s to 1,3107s	0h…FFFFh	20µs
Time 2 (Tx2)	14-15		DOWORD	Time for current 2 step X (Tx2) Value range: 0s to 1,3107s	0h…FFFFh	20µs
Slope Tx1 Step 1 (optional)	16	0	DO	Set Tx1 of Step X as slope time (optional) 0 = Tx1 as current time 1 = Tx1 as slope time	0…1	-
Slope Tx2 Step 1 (optional)	16	1	DO	Set Tx2 of Step X as slope time (optional) 0 = Tx2 as current time 1 = Tx2 as slope time	0…1	-
Reserve	16	2-7	DO	Reserve	0…1	-
Cycles	17		DOBYTE	Cycles for step X	0h…C7h	-

Signal name	Byte	Bit	Signal type	Description	Value range	Unit
Handshake	18	0	DO	Handshake	0…1	-
Reserve	18	1-7	DOBYTE	Reserve	0…1	-
Step number X	19	0-7	DOBYTE	Step number X Value range: 0 to 16	0h…10h	1 Step
Data PRPS 2	**20-39**	**Data for PRPS 2**				
Status	**20-21**		**Byte**	**Status**		
Percentage set point regulator	22-23		DOWORD	Percentage set point regulator 0.00% - 100.00%	0h … 2710h	depending on device
Waveform for step X PRPS 3	**24-39**	**Waveform for step X PRPS 2**				
Data PRPS 3	**40-59**	**Data for PRPS 3**				
Status	**40-41**		**Byte**	**Status**		
Percentage set point regulator	42-43		DOWORD	Percentage set point regulator 0.00% - 100.00%	0h … 2710h	depending on device
Waveform for step X PRPS 3	**44-59**	**Waveform for step X PRPS 3**				
Data PRPS 4	**60-79**	**Data for PRPS 4**				
Data PRPS 5	**80-99**	**Data for PRPS 5**				
Data PRPS 6	**100-119**	**Data for PRPS 6**				
Data PRPS 7	**120-139**	**Data for PRPS 7**				
Data PRPS 8 … Data PRPS 16	**140-319**	**Data for PRPS 8 to PRPS 16**				

Legend:

DO	>>>	digital output: Bit	DI	>>>	digital input: Bit
DOBYTE	>>>	digital output: Byte	DIBYTE	>>>	digital input: Byte
DOWORD	>>>	digital output: Word	DIWORD	>>>	digital input: Word

3.2 Input bytes

Signal name	Byte	Bit	Signal type	Description	Value range	Unit
Data PRPS 1	**0-29**			**Data from PRPS 1**		
Actual As-counter	0-3		DIDWORD	Actual As-counter 0 to 4294967295	0h… FFFFFFFFh	1 As
Actual status	**4-5**	**0-7**	**DIBYTE**	**Actual status**		
Error from the past	4	0	DI	Error from the past 0 = OK 1 = Error from the past	0…1	
Reserve	4	1-6	DI	Reserve	0…1	
Status handshake	4	7	DI	Status handshake	0…1	
Operating status	5	0	DI	Operating status 0 = OFF 1 = ON	0…1	
Range error	5	1	DI	Range error 0 = Idle state 1 = Range error	0…1	
Watchdog / Reset	5	2	DI	Watchdog / Reset 0 = Idle state 1 = Watchdog / Reset	0…1	
Operation mode	5	3	DI	Operation mode 0 = Manual 1 = Automatic	0…1	
As counter overflow	5	4	DI	As counter overflow 0 = Idle state 1 = As counter overflow	0…1	
Actual warning	5	5	DI	Actual warning 0 = OK 1 = Actual warning	0…1	
Actual error	5	6	DI	Actual error 0 = OK 1 = Actual error	0…1	
Warning from the past	5	7	DI	Warning from the past 0 = OK 1 = Warning from the past	0…1	
Actual average current	6-7		DIWORD	Actual average current Value range: -3276.8 to+3276.7	0h…FFFFh	A
Actual average voltage	8-9		DIWORD	Actual average voltage Value range: -3276.8 to+3276.7	0h…FFFFh	V
Messages	**10-29**	**0-7**	**Actual messages and messages from the past**			
Actual messages 1	10-11	0-7	DIBYTE	Actual messages 1	0…1	
Actual messages 2	12-13	0-7	DIBYTE	Actual messages 2	0…1	
Actual messages 3	14-15	0-7	DIBYTE	Actual messages 3	0…1	
Actual messages 4	16-17	0-7	DIBYTE	Actual messages 4	0…1	
Actual messages 5	18-19	0-7	DIBYTE	Actual messages 5	0…1	
Messages from the past 1	20-21	0-7	DIBYTE	Messages from the past 1	0…1	

Signal name	Byte	Bit	Signal type	Description	Value range	Unit
Messages from the past 2	22-23	0-7	DIBYTE	Messages from the past 2	0…1	
Messages from the past 3	24-25	0-7	DIBYTE	Messages from the past 3	0…1	
Messages from the past 4	26-27	0-7	DIBYTE	Messages from the past 4	0…1	
Messages from the past 5	28-29	0-7	DIBYTE	Messages from the past 5	0…1	
Data PRPS 2	**30-59**	**Data from PRPS 2**				
Actual As-counter	30-33		DIDWORD	Actual As-counter 0 to 4294967295	0h… FFFFFFFFh	1 As
Actual status	**34-35**	**0-7**	**DIBYTE**	**Actual status**		
Actual average current	36-37		DIWORD	Actual average current Value range: -3276.8 to+3276.7	0h…FFFFh	A
Actual average voltage	38-39		DIWORD	Actual average voltage Value range: -3276.8 to+3276.7	0h…FFFFh	V
Messages	**40-59**	**0-7**	**Actual messages and messages from the past**			
Data PRPS 3	**60-89**	**Data from PRPS 3**				
Actual As-counter	60-63		DIDWORD	Actual As-counter 0 to 4294967295	0h… FFFFFFFFh	1 As
Actual status	**64-65**	**0-7**	**DIBYTE**	**Actual status**		
Actual average current	66-67		DIWORD	Actual average current Value range: -3276.8 to+3276.7	0h…FFFFh	A
Actual average voltage	68-69		DIWORD	Actual average voltage Value range: -3276.8 to+3276.7	0h…FFFFh	V
Messages	**70-89**	**0-7**	**Actual messages and messages from the past**			
Data PRPS 4	**90-119**	**Data from PRPS 4**				
Data PRPS 5	**120-149**	**Data from PRPS 5**				
Data PRPS 6	**150-179**	**Data from PRPS 6**				
Data PRPS 7	**180-209**	**Data from PRPS 7**				
Data PRPS 8 … Data PRPS 16	**210-479**	**Data from PRPS 8 to PRPS 16**				

Legend:

DO	>>>	digital output: Bit	DI	>>>	digital input: Bit
DOBYTE	>>>	digital output: Byte	DIBYTE	>>>	digital input: Byte
DOWORD	>>>	digital output: Word	DIWORD	>>>	digital input: Word
DODWORD	>>>	digital output: DWord	DIDWORD	>>>	digital input: DWord

3.3 Description output bytes

3.3.1 Status

3.3.1.1 Operating status

This bit is used to turn the power supply ON and OFF, at the same time all data in the Holding registers will be processed. If the waveform data or the percentage regulator has to be changed during a running process, rewrite the desired Holding registers with new data and then it is possible to process the new data by changing the value of the “Accept on change” bit or any other bit of the Status.

(OFF = 0 / ON = 1)

3.3.1.2 Error acknowledge

This bit is used to acknowledge warnings and errors from the past. It is not possible to acknowledge present warnings or errors, in that case it is necessary to eliminate the route cause for the warning or problem first.

(Idle state = 0 / Acknowledge error = 1)

3.3.1.3 As counter reset

The internal As-counter can be reset by setting this bit.
An As-counter overflow cannot be reset by this bit. To reset an As-counter overflow it has to be used the “Error acknowledge” bit.

(Idle state = 0 / As-counter reset = 1)

3.3.1.4 Sync before

This bit is used to synchronize the Pulse Reverse Power Supply output with the Pulse Reverse Power Supply output before.

(Idle state = 0 / Sync before = 1)

3.3.1.5 Accept on change

Every time you want to change the actual set points (percentage regulator or Step1 to 16) you have to write the new set point data. The new data will be accepted by the control unit in the moment you change the value of this bit or any other bit of the Status.

3.3.2 Percentage set point regulator

The percentage set point regulator defines the current/voltage set point for the whole period in per cent with two digits after decimal point. Due to the percentage set point regulator value the amplitudes of the waveform over the whole period are adjustable from 0.00% up to 100,00%.

The range:

0h	…	2710h
0h	>>>	0,00%
1388h	>>>	50,00%
2710h	>>>	100,00%

3.3.3 Waveform for step X

3.3.3.1 Current 1 (Ix1)

Set point for the first current in the step.
The value hast to be transmit with one digit after decimal point.

3.3.3.2 Current 2 (Ix2)

Set point for the second current in the step.
The value hast to be transmit with one digit after decimal point.

3.3.3.3 Voltage 1 (Ux1) (optional)

Set point for the first voltage in the step.
The value hast to be transmit with one digit after decimal point.

3.3.3.4 Voltage 2 (Ux2) (optional)

Set point for the second voltage in the step.
The value hast to be transmit with one digit after decimal point.

3.3.3.5 Time 1 (Tx1)

Time Tx1 is the time value for the duration of the first current and voltage in a step.
The value hast to be multiplied with 20µs.

The max value is 1,3107seconds.

Example:

Tx1 value = 5	>>>	* 20µs	=	0,1ms
Tx1 value = 50	>>>	* 20µs	=	1ms
Tx1 value = 500	>>>	* 20µs	=	10ms
Tx1 value = 5000	>>>	* 20µs	=	100ms
Tx1 value = 50000	>>>	* 20µs	=	1s
Tx1 value = 65535	>>>	* 20µs	=	1,3107s

3.3.3.6 Time 2 (Tx2)

Time Tx2 is the time value for the duration of the second current and voltage in a step.
The value hast to be multiplied with 20µs.

The max value is 1,3107seconds.

Example:

Tx1 value = 5	>>>	* 20µs	=	0,1ms
Tx1 value = 50	>>>	* 20µs	=	1ms
Tx1 value = 500	>>>	* 20µs	=	10ms
Tx1 value = 5000	>>>	* 20µs	=	100ms
Tx1 value = 50000	>>>	* 20µs	=	1s
Tx1 value = 65535	>>>	* 20µs	=	1,3107s

3.3.3.7 Cycles

The cycle value defines how many times the actual step will be repeated in one waveform period. The value has to be divided by 2.

Cycle value = 2	>>>	/ 2	=	1,0	Cycles
Cycle value = 21	>>>	/ 2	=	10,5	Cycles
Cycle value = 199	>>>	/ 2	=	99,5	Cycles

3.3.3.8 Handshake

By toggling the Handshake bit you can confirm the successful transfer of step data to the control unit. At the successful transfer of the step data the “Status handshake” bit in the “Actual status” of the rectifier will have the same value as of Handshake bit.

3.3.3.9 Step number X

The step number value defines to which step number of a waveform the values of Ix1, Ix2, Ux1, Ux2, Tx1, Tx2 and Cycles are belonging to. All these values will be set to the desired waveform step in the moment it will be transmit.

Please note: To set the new transmit waveform data to the control unit as actual set point, you have to change any bit of the status.

The valid value range:

0:	Idle mode
1 to 16:	The value will set the Ix1, Ix2, Ux1, Ux2, Tx1, Tx2 and Cycles to the desired waveform step number.

3.4 Description input bytes

3.4.1 Actual As counter value

This values is the actual As counter value.

3.4.2 Actual status

3.4.2.1 Error from the past

This bit indicates a not present error message. Please check the “Messages from the past” registers.

(OK = 0 / Error from the past = 1)

3.4.2.2 Status handshake

This bit is used in combination with “Handshake” bit of output bytes “Waveform for step X…”. At the successful transfer of step data the Status handshake bit will have the same value as of Handshake bit.

3.4.2.3 Operating status

This bit indicates the actual operating status of the Pulse Reverse Power Supply, If the output is activated or not.

(PRPS (output) OFF = 0 / PRPS (output) ON = 1)

3.4.2.4 Range error

This bit indicates that one or more of the new set values are not within the defined limits (out of range).The new data will not be accepted and the PRPS will continue with the old set points. The PRPS cannot be switched ON as long as this message is present.

(OK = 0, Range error = 1)

3.4.2.5 Operation mode

This bit indicates whether the control unit is set to manual mode for controlling the unit by the integrated display and keypad or in automatic mode for controlling via the RS485 interface!

(Manual mode (by hand) = 0 / Automatic mode (by bus) = 1)

3.4.2.6 Watchdog/Reset

The micro-controller inside the control unit observes his internal activities itself and generates a Reset (Watchdog-Reset) after a malfunction.
A Reset will also be generated after the main power for the control unit is switched on.
After a reset the set values have to be send again.

(OK = 0 / Watchdog / Reset = 1)

3.4.2.7 As-counter overflow

This bit indicates an overflow of the internal As-counter.
This message can be acknowledged.

(Idle state = 0 / As overflow = 1)

3.4.2.8 Actual warning

This bit indicates a present warning message. Please check the “Actual message” registers.

(OK = 0 / Actual warning = 1)

3.4.2.9 Actual error

This bit indicates a present error message. Please check the “Actual message” registers.

(OK = 0 / Actual error = 1)

3.4.2.10 Warning from the past

This bit indicates a not present warning message. Please check the “Messages from the past” registers.

(OK = 0 / Warning from the past = 1)

3.4.3 Actual average current

This value is the actual average current over one whole period.
The value will be transmit with one digit after decimal point.

0h	to	FFFFh
0h	>>>	0
7FFFh	>>>	+3276.7
8000h	>>>	-3276.8

3.4.4 Actual average voltage

This value is the actual average voltage over one whole period.
The value will be transmit with one digit after decimal point.

0h	to	FFFFh
0h	>>>	0
7FFFh	>>>	+3276.7
8000h	>>>	-3276.8

3.4.5 Actual messages 1, messages from the past 1

Status, warning and error messages from the Pulse Reverse Power Supply.

Byte	Bit	Signal name	Description
10, 20 …	0	Error Uz < Uz_{min}	Intermediate circuit voltage too low 0 = Ok 1 = Error
10, 20 …	1	Error Uz > Uz_{max}	Intermediate circuit voltage too high 0 = Ok 1 = Error
10, 20 …	2	Error fault voltage supply DSP	Error voltage supply DSP board 0 = Ok 1 = Error
10, 20 …	3	Error MPP	At least 1 MPP defective 0 = Ok 1 = Error
10, 20 …	4	Error period start	Error period start 0 = Ok 1 = Error
10, 20 …	5	Temperature measurement unit is defective	Temperature measurement unit is defective 0 = Ok 1 = Error
10, 20 …	6	Magnetic valve off	Magnetic valve off 0 = Ok 1 = Magnetic valve off
10, 20 …	7	Parallel PRPS off	Parallel PRPS off 0 = Ok 1 = Parallel PRPS off
11, 21 …	0	Warning over current	Warning over current due to effective value 0 = Ok 1 = Warning
11, 21 …	1	Warning over voltage	Warning over voltage due to effective value 0 = Ok 1 = Warning
11, 21 …	2	Warning over power	Warning over power due to average value 0 = Ok 1 = Warning
11, 21 …	3	Warning temperature	Warning temperature 0 = Ok 1 = Warning
11, 21 …	4	Error over current	Over current switch off due to effective or peak (with switch off) 0 = Ok 1 = Error
11, 21 …	5	Error over voltage	Over voltage switch off due to effective value 0 = Ok 1 = Error
11, 21 …	6	Error over power	Over power switch off due to average value 0 = Ok 1 = Error
11, 21 …	7	Error temperature	Temperature switch off due to high temperature 0 = Ok 1 = Error

3.4.6 Actual messages 2, messages from the past 2

Status, warning and error messages from the Pulse Reverse Power Supply.

Byte	Bit	Signal name	Description
12, 22 …	0	Range error	Range error 0 = Ok 1 = Error
12, 22 …	1	Error SPI comm.	Error SPI communicator 0 = Ok 1 = Error
12, 22 …	2	Error EEPROM set points	Error EEPROM set points lost 0 = Ok 1 = Error
12, 22 …	3	Error EEPROM configuration	Error EEPROM configuration lost 0 = Ok 1 = Error
12, 22 …	4	Error EEPROM device parameter	Error EEPROM device parameter lost 0 = Ok 1 = Error
12, 22 …	5	Error EEPROM DSP parameter	Error EEPROM DSP parameter lost 0 = Ok 1 = Error
12, 22 …	6	Error EEPROM actual values	Error EEPROM actual values lost 0 = Ok 1 = Error
12, 22 …	7	Error EEPROM actual Ah counter value lost	Error EEPROM actual Ah counter value lost 0 = Ok 1 = Error
13, 23 …	0	Error calculating time	Interrupt-calculating time too high 0 = Ok 1 = Error
13, 23 …	1	Error main supply	Error fault mains supply 0 = Ok 1 = Error
13, 23 …	2	Error SPI > DSP	SPI-Error DSP side 0 = Ok 1 = Error
13, 23 …	3	Error DSP parameter	Error DSP parameter 0 = Ok 1 = Error
13, 23 …	4	Regulator limit / pulse duty factor DSP	Regulator limit / pulse duty factor DSP 0 = Ok 1 = Error
13, 23 …	5	DSP reset event	DSP reset event 0 = Ok 1 = DSP reset event
13, 23 …	6	Error reading dataset	Error reading dataset 0 = Ok 1 = Error
13, 23 …	7	Error parameter reading	Error parameter reading 0 = Ok 1 = Error

3.4.7 Actual messages 3, messages from the past 3

Status, warning and error messages from the Pulse Reverse Power Supply.

Byte	Bit	Signal name	Description
14, 24 …	0	Ready for operation	PRPS ready 0 = PRPS not ready 1 = PRPS ready
14, 24 …	1	Operation	PRPS in operation 0 = PRPS off 1 = PRPS on
14, 24 …	2	Dosage active	Dosage active 0 = Idle state 1 = Dosage active
14, 24 …	3	Status Profibus	Status Profibus 0 = PB inactive 1 = PB active
14, 24 …	4	Error Profibus	Error Profibus 0 = Ok 1 = PB inactive
14, 24 …	5	Warning high voltage	Warning high voltage occurred 0 = Ok 1 = Warning
14, 24 …	6	Warning voltage limiter	Warning voltage limiter 0 = Ok 1 = Warning
14, 24 …	7	Warning TimeOut RS485	Warning TimeOut RS485 (CU, Display) 0 = Ok 1 = Warning
15, 25 …	0	Error DSP parameter transmission	Error DSP parameter transmission 0 = Ok 1 = Warning
15, 25 …	1	Warning PK	Warning power supply PK 0 = Ok 1 = Warning
15, 25 …	2	Warning PK temperature.	Error power supply PK temperature 0 = Ok 1 = Error
15, 25 …	3	Error PK temperature	Watchdog / Reset 0 = Ok 1 = Warning Watchdog / Reset
15, 25 …	4	Watchdog / Reset	Error EEPROM type settings lost 0 = Ok 1 = Error
15, 25 …	5	Error EEPROM type settings	Warning power supply PK 0 = Ok 1 = Warning
15, 25 …	6	Error EEPROM dosage value lost	Error EEPROM dosage value lost 0 = Ok 1 = Error
15, 25 …	7	Warning power fail	Warning power-fail 0 = Ok 1 = Warning

3.4.8 Actual messages 4, messages from the past 4

Status, warning and error messages from the Pulse Reverse Power Supply.

Byte	Bit	Signal name	Description
16, 26 …	0	Error EEPROM timer lost	Error EEPROM timer lost 0 = OK 1 = Error EEPROM timer lost
16, 26 …	1	Warning charge too high	Warning charge too high 0 = OK 1 = Warning
16, 26 …	2	PROFIBUS time out	PROFIBUS time out 0 = OK 1 = Error
16, 26 …	3	Error charge too high	Error charge too high 0 = OK 1 = Error
16, 26 …	4	Overload	Overload 0 = Ok 1 = Error
16, 26 …	5	Current error	Current error 0 = Ok 1 = Error
16, 26 …	6	Voltage error	Voltage error 0 = Ok 1 = Error
16, 26 …	7	Voltage error user	Voltage error user 0 = Ok 1 = Error
17, 27 …	0	Ah counter 1	Ah counter 1 0 = Idle state 1 = Ah counter 1
17, 27 …	1	Ah counter 2	Ah counter 2 0 = Idle state 1 = Ah counter 2
17, 27 …	2	Ah counter 3	Ah counter 3 0 = Idle state 1 = Ah counter 3
17, 27 …	3	Ah counter 4	Ah counter 4 0 = Idle state 1 = Ah counter 4
17, 27 …	4	Error MMC logging failed	Error MMC logging failed 0 = Ok 1 = Error
17, 27 …	5	TimeOut SPI-serial telegram	SPI-Serial Telegram TimeOut 0 = Ok 1 = Error
17, 27 …	6	Emergency Off	Emergency Off 0 = Ok 1 = Error
17, 27 …	7	Switch on safety contactor	Switch on safety contactor 0 = Ok 1 = Switch on safety contactor

3.4.9 Actual messages 5, messages from the past 5

Status, warning and error messages from the Pulse Reverse Power Supply.

Byte	Bit	Signal name	Description
18, 28 …	0	External release Ok	External release Ok 0 = Idle state 1 = Ext. release Ok
18, 28 …	1	Batch file loaded	Batch file loaded 0 = Idle state 1 = Batch file loaded
18, 28 …	2	General warning	General warning 0 = Idle state 1 = General warning
18, 28 …	3	General error	General error 0 = Idle state 1 = General error
18, 28 …	4	DSP type unknown	DSP type unknown 0 = Idle state 1 = DSP type unknown
18, 28 …	5-7	Reserve	Reserve
19, 29 …	0	Power error	Power error 0 = OK 1 = Error
19, 29 …	1	Amplifier error	Amplifier error 0 = OK 1 = Error
19, 29 …	2	Fan error	Fan error 0 = OK 1 = Error
19, 29 …	3	Error EEPROM batch data lost	Error EEPROM batch data lost 0 = OK 1 = Error
19, 29 …	4	Error EEPROM correction factor lost	Error EEPROM correction factor lost 0 = OK 1 = Error
19, 29 …	5	U_Trigger error	U_Trigger error 0 = OK 1 = Error
19, 29 …	6	Switch off safety contactor	Switch off safety contactor 0 = Ok 1 = Switch off safety contactor
19, 29 …	7	External release missing	External release missing 0 = Idle state 1 = Ext. release missing

4 Examples

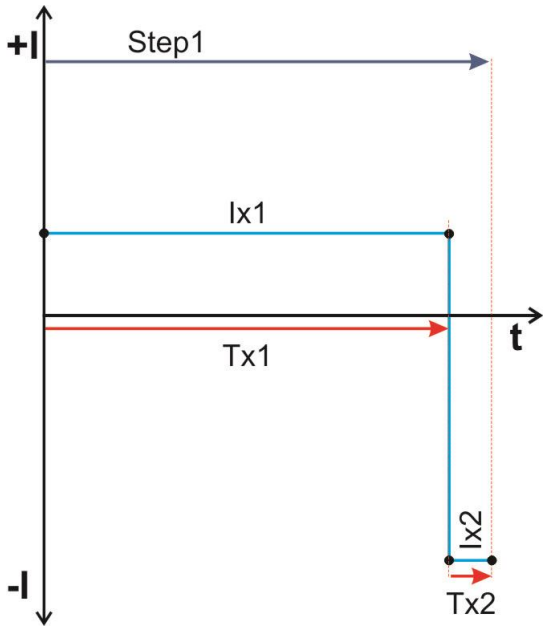
In this chapter you will find different examples how to set or change different waveforms. The examples show which values have to be set.
The examples are made for current controlled PRPS! To set the waveforms for current and voltage controlled PRPS you have just to set additionally the Ux1 and Ux2 value to the desired set point.

4.1 How to set a waveform with one step

4.1.1 How to set a simple standard waveform

This example shows how to set a simple standard waveform with 150A forward current, a current ratio of 3 and a time ratio of 20 for the first PRPS.

To realize a simple standard waveform it is only one step necessary. We have to set the current 1 (Ix1 150A), the current 2 (Ix2 -450A), a time for current 1 (Tx1 10ms), a time for current 2 (Tx2 0,5ms) and one cycle (Cycle 1.0).
To ensure that only the above described waveform will be set, it is recommended to set a “zero” step as step 2, to delete steps from old waveforms which were set before.



1. Setting waveform data for step:

Byte	Bit	Name	Set point	Setting value
4-5		Current 1 step X (Ix1)	150.0 A	05DCh
6-7		Current 2 step X (Ix2)	-450.0 A	EE6Ch
12-13		Time for current 1 step X (Tx1)	10.0 ms	01F4h
14-15		Time for current 2 step X (Tx2)	0.5 ms	0019h
17		Cycles for step X	1.0 Cycles	02h

2. Setting the waveform data to step 1:

Byte	Bit	Name	Set point	Setting value
19	0-7	Step number X Value range: 0 to 16	Step 1	01h

3. Setting the “Step number X” to idle mode

Byte	Bit	Name	Set point	Setting value
19	0-7	Step number X	Idle mode	00h

4. Setting waveform data for a “zero” step:

Byte	Bit	Name	Set point	Setting value
4-5		Current 1 step X (Ix1)	0.0 A	0000h
6-7		Current 2 step X (Ix2)	0.0 A	0000h
12-13		Time for current 1 step X (Tx1)	0.0 ms	0000h
14-15		Time for current 2 step X (Tx2)	0.0 ms	0000h
17		Cycles for step X	0.0 Cycles	00h

5. Setting the waveform data to step 2:

Byte	Bit	Name	Set point	Setting value
19	0-7	Step number X Value range: 0 to 16	Step 2	02h

6. Setting the “Step number X” to idle mode

Byte	Bit	Name	Set point	Setting value
19	0-7	Step number X	Idle mode	00h

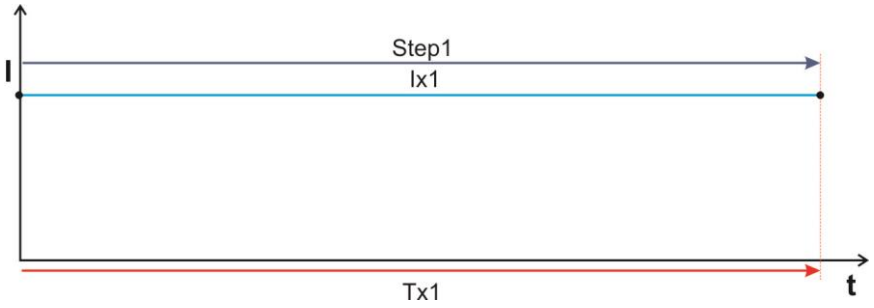
6. Processing the new waveform data and switching on with 100%:

Byte	Bit	Name	Set point	Setting value
1	0-7	Status	---	01h
	0	Operating status	1	
2-3		Percentage set point regulator	100.00 %	2710h

4.1.2 How to set a DC current

This example shows how to set a DC current with 100A for the first PRPS:

To realize a DC current it is only one step necessary. For DC current we have only to set the current 1 (Ix1 100A), any time for current 1 (Tx1 5ms) and one cycle (Cycle 1.0).
To ensure that only the above described waveform will be set, it is recommended to set a “zero” step as step 2, to delete steps from old waveforms which were set before.



1. Setting waveform data for step:

Byte	Bit	Name	Set point	Setting value
4-5		Current 1 step X (Ix1)	100.0 A	03E8h
6-7		Current 2 step X (Ix2)	0.0 A	0000h
12-13		Time for current 1 step X (Tx1)	5.0 ms	00FAh
14-15		Time for current 2 step X (Tx2)	0.0 ms	0000h
17		Cycles for step X	1.0 Cycles	02h

2. Setting the waveform data to step 1:

Byte	Bit	Name	Set point	Setting value
19	0-7	Step number X Value range: 0 to 16	Step 1	01h

3. Setting the “Step number X” to idle mode

Byte	Bit	Name	Set point	Setting value
19	0-7	Step number X	Idle mode	00h

4. Setting waveform data for a “zero” step:

Byte	Bit	Name	Set point	Setting value
4-5		Current 1 step X (Ix1)	0.0 A	0000h
6-7		Current 2 step X (Ix2)	0.0 A	0000h
12-13		Time for current 1 step X (Tx1)	0.0 ms	0000h
14-15		Time for current 2 step X (Tx2)	0.0 ms	0000h
17		Cycles for step X	0.0 Cycles	00h

5. Setting the waveform data to step 2:

Byte	Bit	Name	Set point	Setting value
19	0-7	Step number X Value range: 0 to 16	Step 2	02h

6. Setting the “Step number X” to idle mode

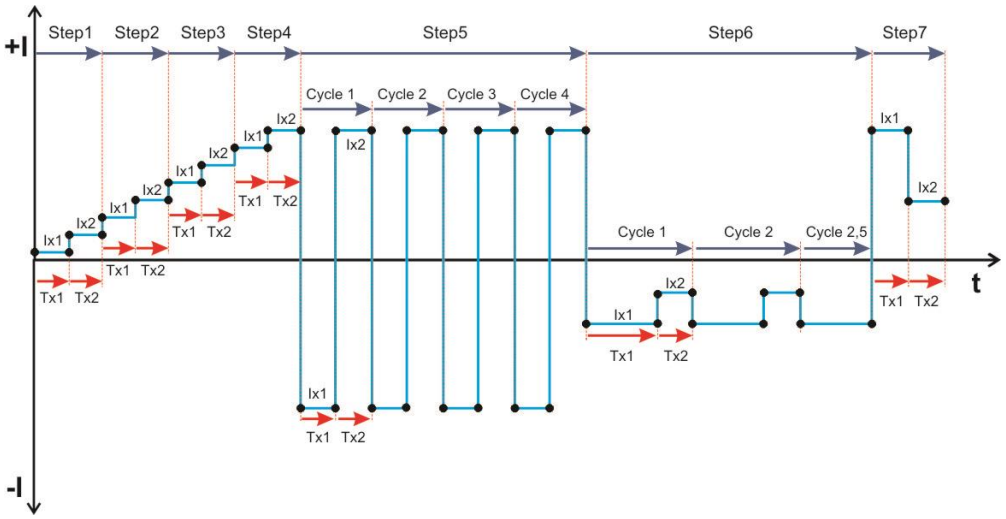
Byte	Bit	Name	Set point	Setting value
19	0-7	Step number X	Idle mode	00h

6. Processing the new waveform data and switching on with 100%:

Byte	Bit	Name	Set point	Setting value
1	0-7	Status	---	01h
	0	Operating status	1	
2-3		Percentage set point regulator	100.00 %	2710h

4.2 How to set a complex waveform

This example shows how to set a complex waveform with 7 steps for the first PRPS.



1. Setting waveform data for step:

Byte	Bit	Name	Set point	Setting value
4-5		Current 1 step X (Ix1)	10.0 A	0064h
6-7		Current 2 step X (Ix2)	30.0 A	012Ch
12-13		Time for current 1 step X (Tx1)	5.0 ms	00FAh
14-15		Time for current 2 step X (Tx2)	5.0 ms	00FAh
17		Cycles for step X	1.0 Cycles	02h

2. Setting the waveform data to step 1:

Byte	Bit	Name	Set point	Setting value
19	0-7	Step number X	Step 1	01h

3. Setting the “Step number X” to idle mode

Byte	Bit	Name	Set point	Setting value
19	0-7	Step number X	Idle mode	00h

4. Setting waveform data for step:

Byte	Bit	Name	Set point	Setting value
4-5		Current 1 step X (Ix1)	50.0 A	01F4h
6-7		Current 2 step X (Ix2)	70.0 A	02BCh
12-13		Time for current 1 step X (Tx1)	5.0 ms	00FAh
14-15		Time for current 2 step X (Tx2)	5.0 ms	00FAh
17		Cycles for step X	1.0 Cycles	02h

5. Setting the waveform data to step 2:

Byte	Bit	Name	Set point	Setting value
19	0-7	Step number X	Step 2	02h

6. Setting the “Step number X” to idle mode

Byte	Bit	Name	Set point	Setting value
19	0-7	Step number X	Idle mode	00h

7. Setting waveform data for step:

Byte	Bit	Name	Set point	Setting value
4-5		Current 1 step X (Ix1)	90.0 A	0384h
6-7		Current 2 step X (Ix2)	110.0 A	044Ch
12-13		Time for current 1 step X (Tx1)	5.0 ms	00FAh
14-15		Time for current 2 step X (Tx2)	5.0 ms	00FAh
17		Cycles for step X	1.0 Cycles	02h

8. Setting the waveform data to step 3:

Byte	Bit	Name	Set point	Setting value
19	0-7	Step number X	Step 3	03h

9. Setting the “Step number X” to idle mode

Byte	Bit	Name	Set point	Setting value
19	0-7	Step number X	Idle mode	00h

10. Setting waveform data for step:

Byte	Bit	Name	Set point	Setting value
4-5		Current 1 step X (Ix1)	130.0 A	0514h
6-7		Current 2 step X (Ix2)	150.0 A	05DCh
12-13		Time for current 1 step X (Tx1)	5.0 ms	00FAh
14-15		Time for current 2 step X (Tx2)	5.0 ms	00FAh
17		Cycles for step X	1.0 Cycles	02h

11. Setting the waveform data to step 4:

Byte	Bit	Name	Set point	Setting value
19	0-7	Step number X	Step 4	04h

12. Setting the “Step number X” to idle mode

Byte	Bit	Name	Set point	Setting value
19	0-7	Step number X	Idle mode	00h

13. Setting waveform data for step:

Byte	Bit	Name	Set point	Setting value
4-5		Current 1 step X (Ix1)	-150.0 A	FA24h
6-7		Current 2 step X (Ix2)	150.0 A	05DCh
12-13		Time for current 1 step X (Tx1)	5.0 ms	00FAh
14-15		Time for current 2 step X (Tx2)	5.0 ms	00FAh
17		Cycles for step X	4.0 Cycles	08h

14. Setting the waveform data to step 5:

Byte	Bit	Name	Set point	Setting value
19	0-7	Step number X	Step 5	05h

15. Setting the “Step number X” to idle mode

Byte	Bit	Name	Set point	Setting value
19	0-7	Step number X	Idle mode	00h

16. Setting waveform data for step:

Byte	Bit	Name	Set point	Setting value
4-5		Current 1 step X (Ix1)	-70.0 A	FD44h
6-7		Current 2 step X (Ix2)	-35.0 A	FEA2h
12-13		Time for current 1 step X (Tx1)	10.0 ms	01F4h
14-15		Time for current 2 step X (Tx2)	5.0 ms	00FAh
17		Cycles for step X	2.5 Cycles	05h

17. Setting the waveform data to step 6:

Byte	Bit	Name	Set point	Setting value
19	0-7	Step number X	Step 6	06h

18. Setting the “Step number X” to idle mode

Byte	Bit	Name	Set point	Setting value
19	0-7	Step number X	Idle mode	00h

19. Setting waveform data for step:

Byte	Bit	Name	Set point	Setting value
4-5		Current 1 step X (Ix1)	150.0 A	05DCh
6-7		Current 2 step X (Ix2)	70.0 A	02BCh
12-13		Time for current 1 step X (Tx1)	5.0 ms	00FAh
14-15		Time for current 2 step X (Tx2)	5.0 ms	00FAh
17		Cycles for step X	1.0 Cycles	02h

20. Setting the waveform data to step 7:

Byte	Bit	Name	Set point	Setting value
19	0-7	Step number X	Step 7	07h

21. Setting the “Step number X” to idle mode

Byte	Bit	Name	Set point	Setting value
19	0-7	Step number X	Idle mode	00h

22. Setting waveform data for a “zero” step:

Byte	Bit	Name	Set point	Setting value
4-5		Current 1 step X (Ix1)	0.0 A	0000h
6-7		Current 2 step X (Ix2)	0.0 A	0000h
12-13		Time for current 1 step X (Tx1)	0.0 ms	0000h
14-15		Time for current 2 step X (Tx2)	0.0 ms	0000h
17		Cycles for step X	0.0 Cycles	00h

23. Setting the waveform data to step 8:

Byte	Bit	Name	Set point	Setting value
19	0-7	Step number X	Step 8	08h

24. Setting the “Step number X” to idle mode

Byte	Bit	Name	Set point	Setting value
19	0-7	Step number X	Idle mode	00h

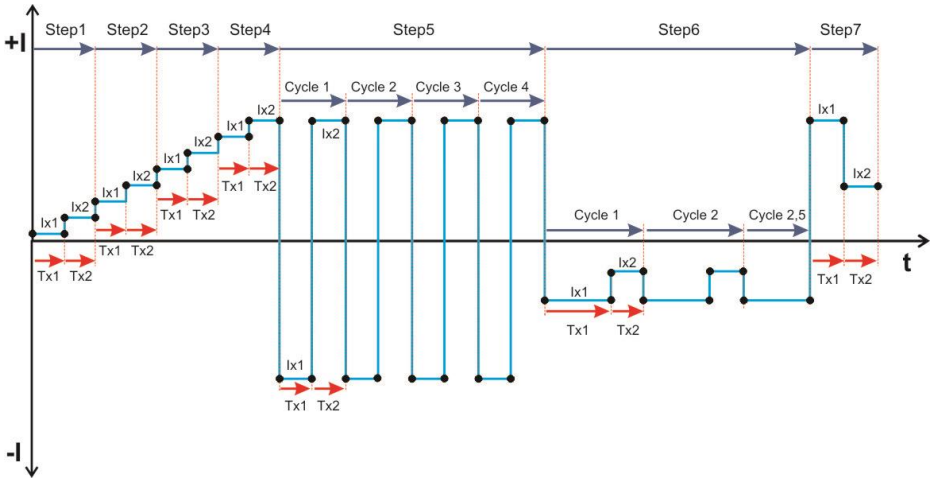
25. Processing the new waveform data and switching on with 100%:

Byte	Bit	Name	Set point	Setting value
1	0-7	Status	---	01h
	0	Operating status	1	
2-3		Percentage set point regulator	100.00 %	2710h

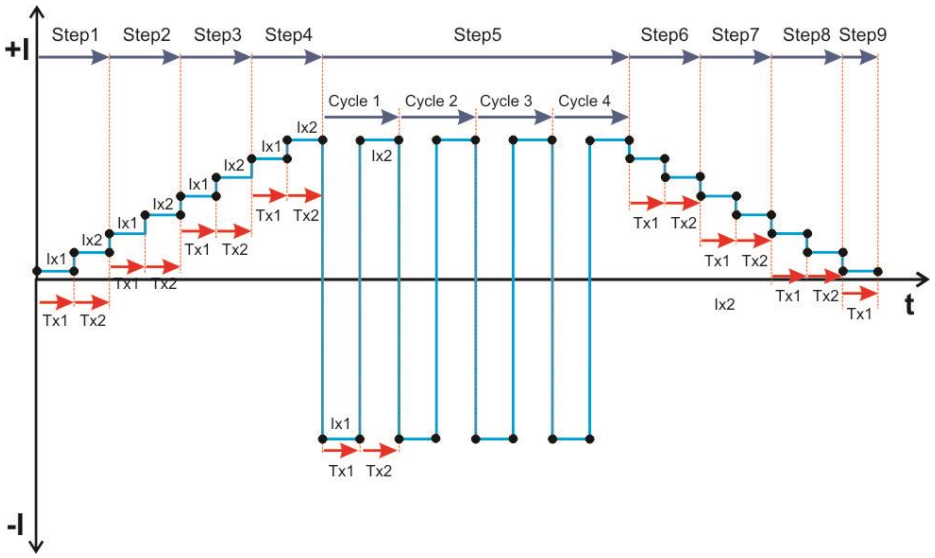
4.3 How to change a running waveform

4.3.1 How to change steps and add new steps

This example shows how to change a running waveform. We take it that the waveform from the example before is running at the moment:



This example shows how to change the running waveform with 7 steps to the following waveform with 9 steps:



The running waveform is from step 1 to step 5 exactly the same, so you have nothing to change at these steps. You have just to send the new data for step6 to step9. During this change the PRPS will continue with the old running waveform until you process the new data by changing the value of “Accept on change” bit in the status byte.

1. Setting waveform data for step:

Byte	Bit	Name	Set point	Setting value
4-5		Current 1 step X (Ix1)	130.0 A	0514h
6-7		Current 2 step X (Ix2)	110.0 A	044Ch
12-13		Time for current 1 step X (Tx1)	5.0 ms	00FAh
14-15		Time for current 2 step X (Tx2)	5.0 ms	00FAh
17		Cycles for step X	1.0 Cycles	02h

2. Setting the waveform data to step 6:

Byte	Bit	Name	Set point	Setting value
19	0-7	Step number X	Step 6	06h

3. Setting the “Step number X” to idle mode

Byte	Bit	Name	Set point	Setting value
19	0-7	Step number X	Idle mode	00h

4. Setting waveform data for step:

Byte	Bit	Name	Set point	Setting value
4-5		Current 1 step X (Ix1)	90.0 A	0384h
6-7		Current 2 step X (Ix2)	70.0 A	02BCh
12-13		Time for current 1 step X (Tx1)	5.0 ms	00FAh
14-15		Time for current 2 step X (Tx2)	5.0 ms	00FAh
17		Cycles for step X	1.0 Cycles	02h

5. Setting the waveform data to step 7:

Byte	Bit	Name	Set point	Setting value
19	0-7	Step number X	Step 7	07h

6. Setting the “Step number X” to idle mode

Byte	Bit	Name	Set point	Setting value
19	0-7	Step number X	Idle mode	00h

7. Setting waveform data for step:

Byte	Bit	Name	Set point	Setting value
4-5		Current 1 step X (Ix1)	50.0 A	01F4h
6-7		Current 2 step X (Ix2)	30.0 A	012Ch
12-13		Time for current 1 step X (Tx1)	5.0 ms	00FAh
14-15		Time for current 2 step X (Tx2)	5.0 ms	00FAh
17		Cycles for step X	1.0 Cycles	02h

8. Setting the waveform data to step 8:

Byte	Bit	Name	Set point	Setting value
19	0-7	Step number X	Step 8	08h

9. Setting the “Step number X” to idle mode

Byte	Bit	Name	Set point	Setting value
19	0-7	Step number X	Idle mode	00h

10. Setting waveform data for step:

Byte	Bit	Name	Set point	Setting value
4-5		Current 1 step X (Ix1)	10.0 A	0064h
6-7		Current 2 step X (Ix2)	0.0 A	0000h
12-13		Time for current 1 step X (Tx1)	5.0 ms	00FAh
14-15		Time for current 2 step X (Tx2)	0.0 ms	0000h
17		Cycles for step X	1.0 Cycles	02h

11. Setting the waveform data to step 9:

Byte	Bit	Name	Set point	Setting value
19	0-7	Step number X	Step 9	09h

12. Setting the “Step number X” to idle mode

Byte	Bit	Name	Set point	Setting value
19	0-7	Step number X	Idle mode	00h

13. Setting waveform data for a “zero” step:

Byte	Bit	Name	Set point	Setting value
4-5		Current 1 step X (Ix1)	0.0 A	0000h
6-7		Current 2 step X (Ix2)	0.0 A	0000h
12-13		Time for current 1 step X (Tx1)	0.0 ms	0000h
14-15		Time for current 2 step X (Tx2)	0.0 ms	0000h
17		Cycles for step X	0.0 Cycles	00h

14. Setting the waveform data to step 10:

Byte	Bit	Name	Set point	Setting value
19	0-7	Step number X	Step 10	0Ah

15. Setting the “Step number X” to idle mode

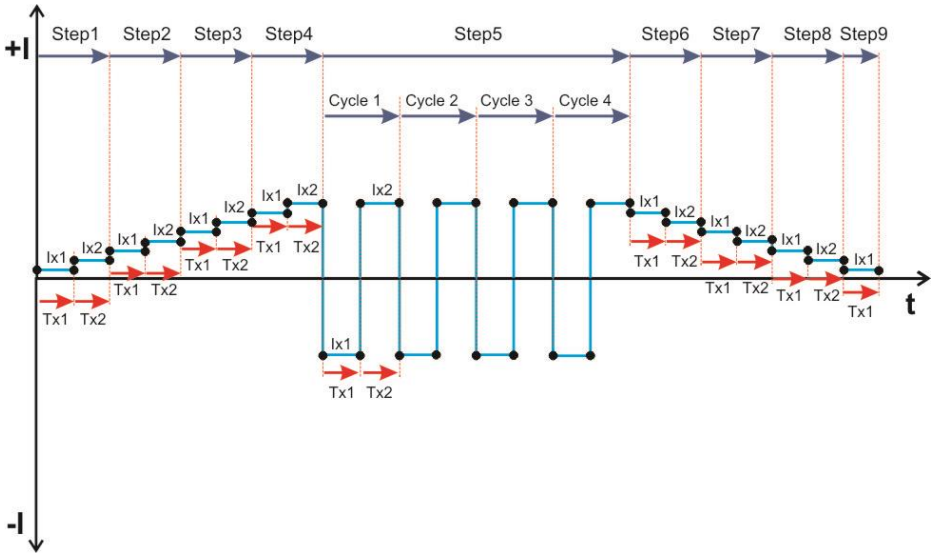
Byte	Bit	Name	Set point	Setting value
19	0-7	Step number X	Idle mode	00h

16. Processing the new waveform data with 100%:

Byte	Bit	Name	Set point	Setting value
1	0-7	Status	---	81h
	0	Operating status	1	
	7	Accept on change	1	
2-3		Percentage set point regulator	100.00 %	2710h

4.3.2 How to reduce the amplitudes of a running waveform to 50%

This example shows how to change a running waveform. We take it that the changed waveform from the example before is running at the moment Now the amplitudes of the waveform should be reduced to 50,00%:



1. Setting the amplitudes of the waveform to 50%:

Byte	Bit	Name	Set point	Setting value
2-3		Percentage set point regulator	50.00 %	1388h

2. Processing the new waveform:

Byte	Bit	Name	Set point	Setting value
1	0-7	Status	---	01h
	0	Operating status	1	
	7	Accept on change	0	

5 Revision list

Version	Page	Modification	Name	Date
TS-FMB0V90-002-E-V01		Document released	TTR	08.06.17
TS-FMB0V90-002-E-V02	 3 8 8 8 10	Changed the description of: “Definition of waveform” “Operating status” bit “Accept on change” bit “Percentage set point regulator” value “Step number X” value	TTR	01.02.18
TS-FMB0V90-002-E-V03	3 3	Added the module for DeviceNet Added the module for EtherNet/IP	TTR	09.04.18
TS-FMB0V90-002-E-V04	5, 10, 6, 10,	Added toggle bit “Handshake” Added bit “Status handshake”	TTR	19.07.18