Sunny Boy

Session Protocol

Version 1.0

Sunny Net

SWRNET-11:KE3197

Alteration Review

Document number[1)] SWRNET	**Version and alteration overview**	**Alteration type**	**Issued**
-10:KD0896	First Edition		Jan. 96
-11:KD0897	Expansion and restriction of faults	C	Feb. 97
			page:1/1

1) Corresponds with the four digits after the colon in the document number on the cover

2) A: Alteration due to faulty documentation or improvement of the documentation

B: Alterations maintaining full or upward compatibility

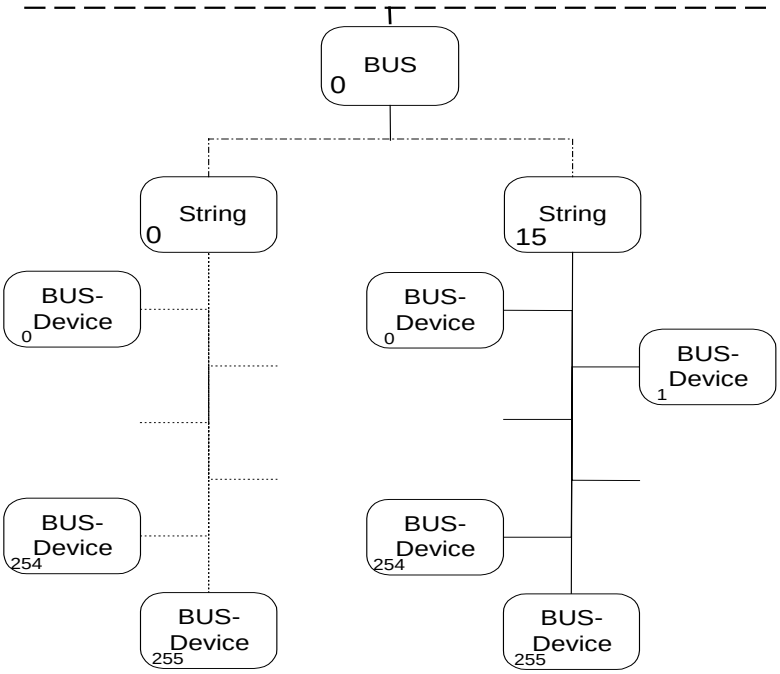
C: Alterations limiting or excluding compatibility

Contents

1 Sunny Net Transmission Protocol

The transmission protocol described in the following has the aim to grant the greatest possible flexibility and transmission safety. As transmission media are considered as well the Power Line Modem as RS232 and RS485.

The protocol is based on the following network topology:



Each participant of the network possesses a unique network address, which consists of a bus address, a string address and a device address. With this type of addressing, 256 devices can be addressed per logic string. At a maximum of 16 strings this results in an address range of up to 4096 (16 x 256) devices. The bus address serves for the separation of neighbouring plants (maximum 15).

Another type of addressing is the group addressing. Up to 2^{16} = 65536 groups can be defined. Here, each network participant can be allocated to one or several optional groups, independent of string and bus.

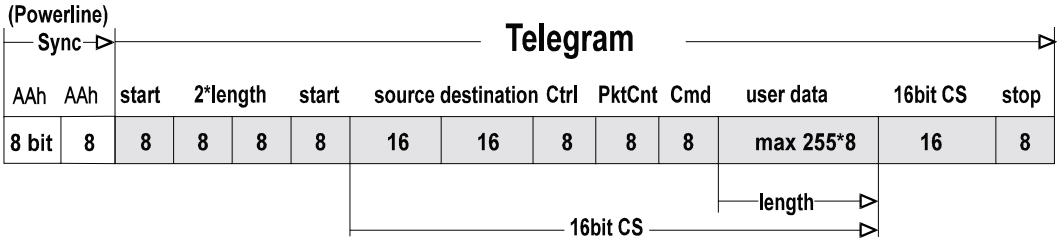
In order to provide the possibility of net-global broadcast telegrams, all bus participants automatically belong to group 0.

The data exchange between single net participants takes place via single data telegrams, which contain as well the telegram source address as the destination address. This way of addressing allows that on principle each network participant is able to communicate with any other network participant, so that there is no dedicated Master/Slave Communication.

2 Data Telegram Format

Data telegrams consist of two parts, the telegram frame and the actual user data. The telegram frame contains the Length information, the telegram source and destination addresses, the check sum as well as a control byte for packet handling. The user data consist of the respective command and the appropriate data.

If the communication takes place via Powerline, a synchronization sequence will be sent ahead of each telegram, consisting of two AA(hex) bytes in series. This sequence does not belong to the telegram and serves only for `training` the FSK(Frequency Shift Keying) demodulator.



Abbr.	Name	Description	Value
start	start byte	telegram start byte	68h
length(2x)	lenght byte	number of user data byte	0 - 255
start	start byte	telegram start byte	68h
source	source address	telegram sender *network address*	
destination	destination address	telegram receiver network address or group address	
Ctrl	control byte	bit 7 procedure of addressing (0=adr. / 1=group) bit 6 acknowledge (0=request / 1=answer) bit 0-5 reserve (0)	
PktCnt	packet counter	number of telegram packets	0-255h
Cmd	command	This is the command of the telegram sender to the destination address	0-255h
user data		The user data content of a telegram can be between 0 and 255 bytes in dependence of the command	
CS	check sum	16-bit check sum The check sum is generated by the byte for byte addition of the telegram bytes, starting with the source address until inclusively the last user data byte	
stop	stop byte	telegram stop byte	16h

Start byte:

In order to make possible a synchronization on the telegram start, all telegrams begin with the start character (68 hex). This character appears always as first and fourth byte in a new telegram sequence.

Length byte:

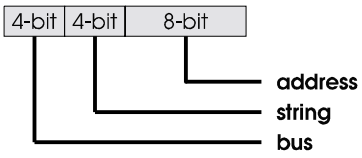
The length byte informs about the length of the user data included in the telegram. This information appears double as second and third character in a telegram.

Telegram addresses (Source/Destination):

The source address of a telegram is always the network address of the telegram sender. The destination address of a telegram can either be the network address of a single receiver or the group address of several receivers. The selection of the way of destination addressing takes place via bit 7 of the Ctrl-byte of a telegram.

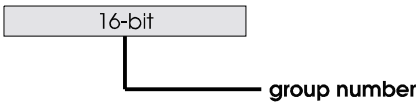
network address (as source- or destination address):

The network address consists of bus-(4 bit), string-(4 bit) and device address (8 bit):



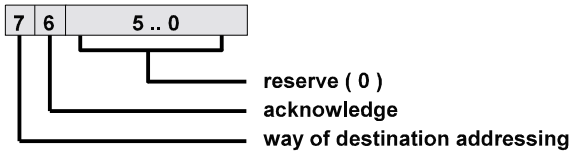
group address (only as destination address):

A group address consists of a 16-Bit number.



Control byte:

The control byte is composed as follows:



Bit 7: This bit selects the kind of the destination address. If it is set, the destination address is a group address, otherwise the destination address is a network address.

Bit 6: 0 = request telegram
1 = response telegram

Bit 0..5: reserved (=0)

Packet counter:

This byte contains the number of following telegrams, if the length of user data amounts to more than 255 bytes. If the value is zero this is the last telegram packet.

Command byte:

The command byte contains the actual command to one or several network participants.

User data:

The content of user data of a telegram depends on the respective command. A maximum of 255 bytes can be transmitted per telegram. According to the command the content of user data can as well have the length zero.

Check sum:

The check sum is a 16-bit value. It is generated by adding byte after byte of the telegram, beginning with the source address until inclusively the last user data byte.

Stop byte:

In order to recognize a distinct end of the telegram, all telegrams will be completed with the stop byte (16 hex).

3 Communication procedure

Independent of the used transmission media (Powerline, RS232, RS485) the following rules are valid:

- Only one participant of the network sends at a time, all the other participants behave passively and listen only.
- Basically each telegram, transmitted per network address, is confirmed by the receiver. This confirmation takes place independently of the telegram content with set Acknowledge Bit in the Control byte of the telegram.

3.1 Data request from a destination device (Single telegram)

1. Request of source device	Acknowledge Bit	= 0
	user data	= according to command
2. Response of destination device	Acknowledge Bit	= 1
	packet counter	= 0
	user data	= acc. to command

3.2 Data request from a destination device (Multiple telegram)

Example:

600 Bytes user data shall be transmitted from the destination device to the source device. As a maximum of 255 characters can be transmitted per telegram the transmission is carried out in three packets:

Packet no. 1:

1. Request of source device	Acknowledge Bit	= 0
2. Response of destination device	Acknowledge Bit	= 1
	packet counter	= 2
	user data	= 255 byte

Packet no. 2:

3. Request of source device	Acknowledge Bit	= 0
	packet counter	= 2
4. Response of destination device	Acknowledge Bit	= 1
	packet counter	= 1
	user data	= 255 byte

Packet no. 3:

5. Request of source device	Acknowledge Bit	= 0
	packet counter	= 1
6. Response of destination device	Acknowledge Bit	= 1
	packet counter	= 0
	user data	= 90 byte

This mechanism also allows the source device to demand faulty packets again.

Packet no. 1:

1. Request of source device	Acknowledge Bit	= 0
2. Response of destination device	Acknowledge Bit	= 1
	packet counter	= 2
	user data	= 255 byte

Packet no. 2:

3. Request of source device	Acknowledge Bit	= 0

	packet counter	= 2

4. Faulty packet is recognized or Timeout!!!

4. Request of source device	Acknowledge Bit	= 0
	packet counter	= 2
5. Response of destination device	Acknowledge Bit	= 1
	packet counter	= 1
	user data	= 255 byte

Packet no. 3:

6. Request of source device	Acknowledge Bit	= 0
	packet counter	= 1
7. Response of destination device	Acknowledge Bit	= 1
	packet counter	= 0
	user data	= 90 byte

3.3 Data Request from Several Destination Devices per Group Address

Broadcast

In order to avoid bus collisions the answer on broadcast requests is always carried out after a transmission pause of 70+random value (0...4790) ms.

1. Request of source device	Acknowledge Bit	= 0
	user data	= acc. to command
2. Transmission pause (? ms)		
3. Response of group member 1	Acknowledge Bit	= 1
	user data	= acc. to command
4. Transmission pause (? ms)		
5. Response of group member 2	Acknowledge Bit	= 1
	user data	= acc. to command
6. Transmission pause (? ms)		
7. Response of group member 3	Acknowledge Bit	= 1
	user data	= acc. to command
8. Transmission pause (? ms)		

4 Commands

4.1 Commands for system configuration

4.1.1 Request for Sunny Net configuration (CMD_GET_NET 1)

Broadcast

This command serves for the registration of the Sunny Net configuration. All participants of Sunny Net send their current network address, serial number and device type designation. In order to avoid bus collisions the answer is carried out after a transmission pause of 70+random value (0...4790) ms.

Request:

Cmd: 01
Ctrl: 10000000 b
Data content: -
Length: 0 + 16 Bytes for frame
Time of transm.: 133 ms (incl. frame + syncbytes at 1200 baud)
Source address: Sunny Data network address
destination addr: group 0
Example:

Sync	Sync	start	length	length	start	source	destination	Ctrl	PkCnt	Cmnd
AA	AA	68	00	00	68	00 00	00 00	80	00	01

CS	stop
81 00	16

Response:

Cmd: 01
Ctrl: 01000000 b
Data content: SWR-serial number (dword)
type of device e.g. ‘SWR 700’ (8 char);

if the type name contains less than 8 characters, the difference has to be filled up with ASCII-zeros

Length: 12-Byte + 16 Bytes for frame

Time of transm.: 233 ms (incl. frame + syncbytes at 1200 baud)

Source address: SWR network address

Destination addr.: Sunny Data network address

Example

Sync	Sync	start	length	length	start	source	destination	Ctrl	Count	Cmnd
AA	AA	68	0C	0C	68	01 00	00 00	40	00	01

user data Snr=9380933	user data type of device =WR700-70	CS	stop
45 24 8F 00	57 52 37 30 30 2D 37 30	0E 03	16

4.1.2 Search for SWR (CMD_SEARCH_SWR 2)

Broadcast

This command serves for the contact with a certain SWR via its serial number. The SWR answers with its current network address, serial number and device type designation.

Request:

Cmd: 02

Ctrl: 10000000 b

Data content : SWR serial number (dword)

Length: 4-byte + 16 bytes for frame

Time of transm.: 167 ms (incl. frame + syncbytes at 1200 baud)

Source address: Sunny Data network address

Destination addr.: group 0

Response:

Cmd:	02
Ctrl:	01000000 b
Data content:	SWR-serial number (dword) type of device e.g. ‘WR 700-7’ (8 char); if the type name contains less than 8 characters, the difference has to be filled up with ASCII-zeros
Length:	12-Byte + 16 Bytes for frame
Time of transm.:	233 ms (incl. frame + syncbytes at 1200 baud)
Source address:	SWR network address
Destination addr.:	Sunny Data network address
Time of transm.:	133 ms (incl. frame + syncbytes at 1200 baud)

4.1.3 Configure SWR Address (CMD_CFG_SWRADR 3)

Broadcast

This command has the aim to configure a certain SWR via its serial number. The SWR answers with its new network address and serial number. After receipt of this command a reaction on CMD_GET_NET is suppressed until by another broadcast command like CMD_SYN_ONLINE or CMD_GET_NET_START the reaction on CMD_GET_NET is released again. This command is needed in order to integrate new or exchanged SWRs, which have no or only an unvalid address in the Sunny Net.

Request:

Cmd:	03
Ctrl:	10000000 b
Data content:	SWR serial number (dword) network address (word)
Length:	6-byte + 16 Bytes for frame
Time of transm.:	183 ms (incl. frame + syncbytes at 1200 baud)
Source address:	Sunny Data network address

destination addr: group 0

Example:

Sync	Sync	start	length	length	start	source	destination	Ctrl	Count	Cmnd
AA	AA	68	06	06	68	00 00	00 00	80	00	03

user data Snr=9380933	user data network address =01	CS	stop
45 24 8F 00	01 00	7C 01	16

Response:

Cmd: 03

Ctrl: 01000000 b

Data content: SWR-serial number (dword)

Length: 4-Byte + 16 Bytes for frame

Time of transm.: 167 ms (incl. frame + syncbytes at 1200 baud)

Source address: new SWR network address

Destination addr.: Sunny Data network address

Example:

Sync	Sync	start	length	length	start	source	destination	Ctrl	PkCnt	Cmnd
AA	AA	68	04	04	68	01 00	00 00	40	00	03

user data Snr=9380933	CS	stop
45 24 8F 00	3C 01	16

4.1.4 Set the Group address (CMD_SET_GRPADR 4)

(reserved)

4.1.5 Delete Group Address (CMD_DEL_GRPADR 5)

(reserved)

4.1.6 Start of Request Sunny Net Configuration

(CMD_GET_NET_START 6)

Broadcast

This command serves for the start of a Sunny Net Configuration. All Sunny net participants send their current network address, serial number and device type description. In order to avoid bus collisions the answer on broadcast requests is always carried out after a transmission pause of 70+random value (0...4790) ms. This command is for the start of the configuration cycle. All devices, which receive this command, reset their internal marker for already announced, and respond.

Request:

Cmd: 06

Ctrl: 10000000 b

Data content: -

Length: 0 + 16 Bytes for frame

Time of transm.: 133 ms (incl. frame + syncbytes at 1200 baud)

Source address: Sunny Data network address

destination addr: group 0

Example:

Sync	Sync	start	length	length	start	source	destination	Ctrl	PkCnt	Cmnd
AA	AA	68	00	00	68	00 00	00 00	80	00	06

CS	stop
3C 01	16

Response:

Cmd: 06

Ctrl: 01000000 b

Data content: SWR-serial number (dword)

type of device e.g. ‘SWR 700’ (8 char);
if the type name contains less than 8 characters, the difference has to be filled up with ASCII-zeros

Length: 12-Byte + 16 Bytes for frame

Time of transm.: 233 ms (incl. frame + syncbytes at 1200 baud)

Source address: SWR network address

Destination addr.: Sunny Data network address

Example

Sync	Sync	start	length	length	start	source	destination	Ctrl	Count	Cmnd
AA	AA	68	0C	0C	68	01 00	00 00	40	00	06

user data Snr=9380933	user data device type=WR700-70	CS	stop
45 24 8F 00	57 52 37 30 30 2D 37 30	13 03	16

4.1.7 Request of Device Configuration

In order to obtain the greatest possible flexibility concerning measuring channel extensions and alterations, Sunny Data is able to request the measuring and parameter configuration of a Sunny Net participant.

The participant answers with the listing of his (measuring) channel information, i.e., the transmission of the description of all inputs/outputs and parameters takes place. Such a description is composed of a type-independent header and a type-specific extension.

Request:

Cmd: 09

Ctrl: 00000000 b

Data content: -

Length: 0 + 16 Bytes for frame

Time of transm.: 133 ms (incl. frame + syncbytes at 1200 baud)

Source address: Sunny Data network address

destination addr: SWR network address

Example:

Sync	Sync	start	length	length	start	source	destination	Ctrl	PkCnt	Cmnd
AA	AA	68	00	00	68	00 00	01 00	80	00	09

CS	stop
0A 00	16

Response:

Cmd: 09

Ctrl: 01000000 b

PktCnt nnnn= (N-1) packets

Data content: see table

Length: depending to the Length of the channel list of the device

Source address: SWR700 network address

Destination addr.: Sunny Data network address

Example

Sync	Sync	start	length	length	start	source	destination	Ctrl	PkCnt	Cmnd
AA	AA	68	51	51	68	01 00	00 00	40	3B	09

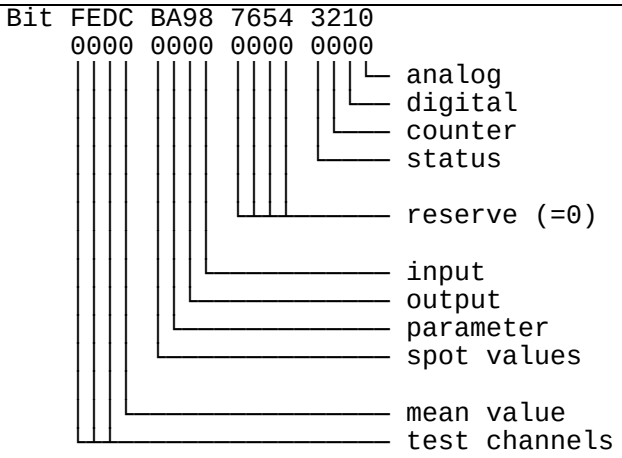
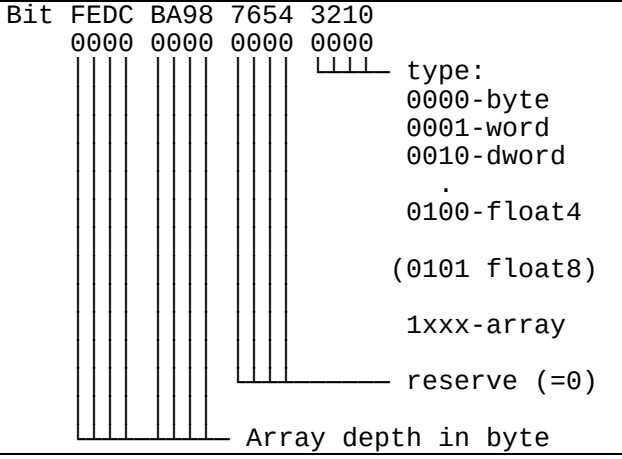
user data index	user data channel type	user data data format	user data level of access	user data name
	analog, parameter	dword, array depth 1		SMA-SN
01	01 04	02 01	02 00	53 4D 41 2D 53 4E 20 20 20 20 20 20 20 20 20 00

user data unit	user data parameter LoVal	user data parameter HiVal	index	...	
„ „	0.0	1.0E6	2	...	...
20 20 20 20 20 20 20 00	00 00 00 00	00 24 74 49	02	...	...

..	..	..	..	CS	stop
..	..	..	..	30 0C	16

Structure of a Channel Description:

Type-independent part:

Abbr.	Name	Description	Type	Value
no.	index	current channel number of this channel type	byte	1..255
cTyp	channel type		word	see description
ntype	data format		word	
nLevel	access level		word	
name	channel name	channel name (clear text)	char 16	
		sum	**23**	**Byte**

analog values:

Abbr.	Name	Description	Type	Value
unit	unit	unit of the channel	char 8	
gain	gain	gain of this channel (parameter LoVal)	float 4	
ofs	offset	offset of the channel (parameter HiVal)	float 4	
		sum	**16**	**Byte**

digital states:

Abbr.	Name	Description	Type	Value
TxtLo	Lo-Text	text signal = 0	char 16	
TxtHi	Hi-Text	text signal <> 0	char 16	
		sum	**32**	**Byte**

counter values:

Abbr.	Name	Description	Type	Value
unit	unit	unit of the channel	char 8	
gain	gain	gain of the channel	float 4	
		sum	**12**	**Byte**

status information:

Abbr.	Name	Description	Type	Value
sizeT	size text field	length of the following string list	word	
statT	status texts	list of zero terminated strings concerning the max. number of states. (the length of a single entry is limited to max. 16 characters)	dynamic	
		sum	**2+SizeT**	**Byte**

4.2 Data Acquisition Commands

4.2.1 Synchronization of Online data (CMD_SYN_ONLINE 10)

Broadcast

In order to grant a simultaneous acquisition of online data, Sunny Data sends a synchronization command with the actual time as broadcast information to all participants on the bus before each interrogation cycle. All devices, which have received this command freeze a copy of the actual (spot) measured values together with the transmitted time. An answer is not sent. After sending the synchronization command the online-data query will take place at each SWR.

Request:

Cmd:	10
Ctrl:	10000000 b
Data content:	time in seconds since 1.1.1970-00:00:00 as Longint, Greenwich Mean Time is used. (no summer/winter time resp. time zones)
Length:	4-Byte + 16 Bytes for frame
Time of transm.:	167 ms (incl. frame + syncbytes at 1200 baud)
Source address:	Sunny Data network address
Destination addr.:	group x

Example:

Sync	Sync	start	length	length	start	source	destination	Ctrl	PkCnt	Cmnd
AA	AA	68	04	04	68	00 00	00 00	80	00	0A

user data 843504044 s	CS	stop
AC D9 46 32	87 02	16

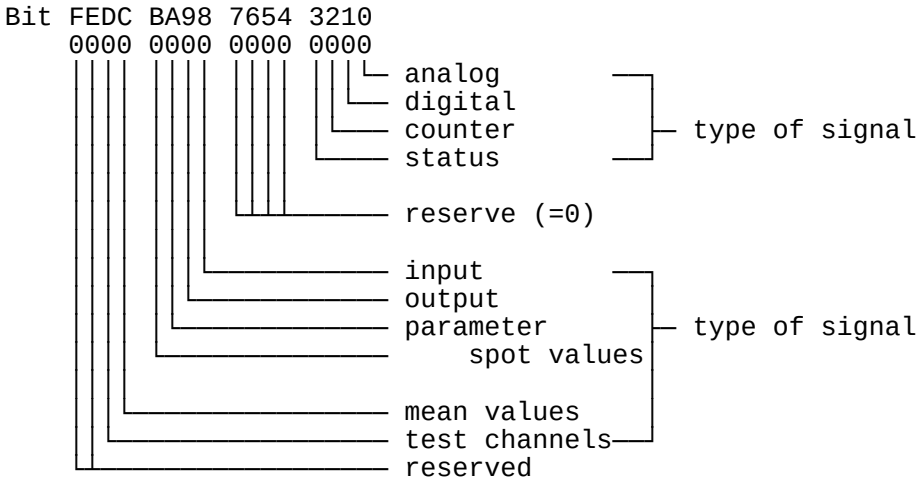
Response: no

4.2.2 Data Request (CMD_GET_DATA 11)

This command makes possible the data acquisition with a user-defined query mask. This mask is identical with the channel type definition of the respective (measuring) channels. The answer is then composed corresponding to the channels chosen in the mask. According to the request profile the structure of the data sets to be transmitted results in:

Request:

Cmd:	11	
Ctrl:	00000000 b	
Data content:	request mask	(word)



	channel no.	(byte)
	= 0 ⇒ all channels according to the mask	
	> 0 ⇒ only one channel (acc. to channel no.)	
Length:	3-Byte + 16 Bytes for frame	
Time of transm.:	158 ms (incl. frame + syncbytes at 1200 baud)	
Source address:	Sunny Data network address	
Destination addr.:	SWR network address	

In principle each desired combination of bits in the request mask is permissible, though this not necessarily makes any sense. Some senseful combinations are:

Bit	FEDC	BA98	7654	3210		
	0000	1001	0000	1111	⇒	request spot values input
=	0	9	0	F	(Hex)	signals
	0001	0001	0000	1111	⇒	request mean values input
=	1	1	0	F	(Hex)	signals
	0000	0001	0000	0100	⇒	request actual counter
=	0	1	0	4	(Hex)	values
	0000	0100	0000	1111	⇒	request of all parameters
=	0	4	0	F	(Hex)	

Example:

Sync	Sync	start	length	length	start	source	destination	Ctrl	Count	Cmnd
AA	AA	68	03	03	68	00 00	01 00	00	00	0B

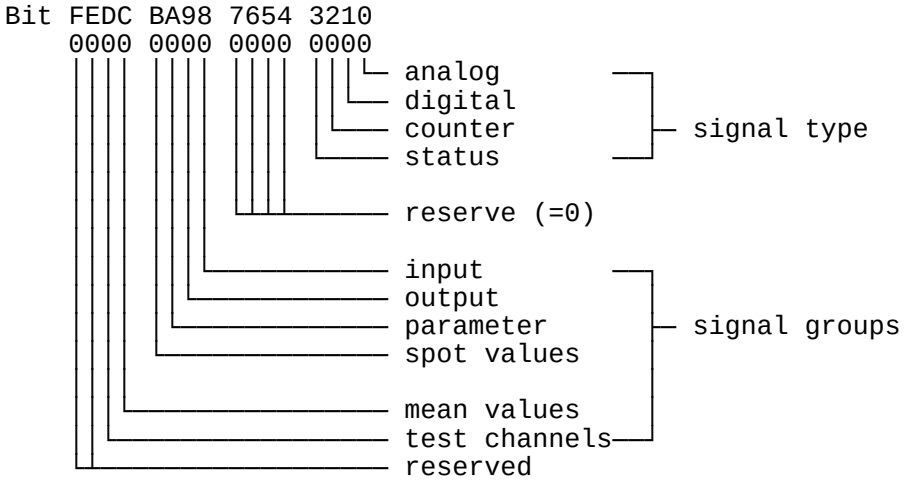
user data request mask	user data channel no.	CS	stop
0F 09	00	24 00	16

Response:

Cmd: 11

Ctrl: 01000000 b

Data content: request mask (word)



channel no. (byte)

= 0 ⇒ all channels according to mask

> 0 ⇒ only one channel (acc. to channel no.)

number of data sets (word)

according to request mask

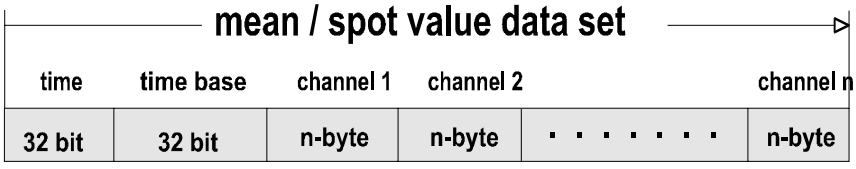
data sets (to be calculated)

Length: 13 + ???

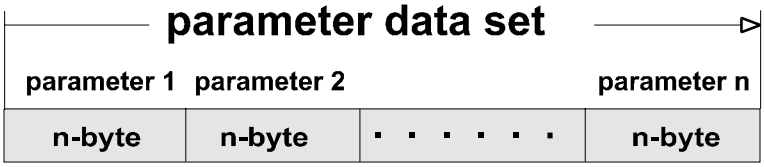
Source address: SWR-network address

Destination addr.: Sunny Data network address

data set format mean/spot value request:



data set format parameter request:



Example spot value request:

Sync	Sync	start	length	length	start	source	destination	Ctrl	PkCnt	Cmnd
AA	AA	68	41	41	68	01 00	00 00	40	00	0B

user data request	user data channel no.	user data number of data sets	user data sec. since 1.1.70	user data time basis
			843517290	
0F 09	00	01 00	6A 0D 47 32	00 00 00 01

analog data K1 Upv-Ist	analog data K2 Upv-Soll	analog data K3 Iac-Ist	analog data K4 Iac-Soll	analog data K5 Uac	analog data K6 Fac
117	196	3748	3	223	4983
75 00	C4 00	A4 0E	03 00	DF 00	77 13

analog data K7 Pac	analog data K8 Zac	analog data K9 d-Zac	analog data K10 R-Iso	analog data K11 Uac-Srr	analog data K12 Fac-Srr
835	37	2954		221	4983
43 03	25 00	7C 13	8A 0B	DD 00	77 13

analog data K13 Zac-Srr	analog data K14 IZac	analog data K15 TKK	counter data K16 E-total	counter data K17 h-total	counter data K18 net-in
37	4765	605	4361490	296068	75
25 00	9D 12	5D 02	12 8D 42 00	84 84 04 00	4B 00 00 00

counter data K19 faultCnt	counter data K20 Snr	status data K21 status	status data K22 fault	CS	stop
86	9380933	= MPP	= ------		

56 00 00 00	45 24 8F 00	07	00	E3 0C	16

4.2.3 Sending of data (CMD_SET_DATA 12)

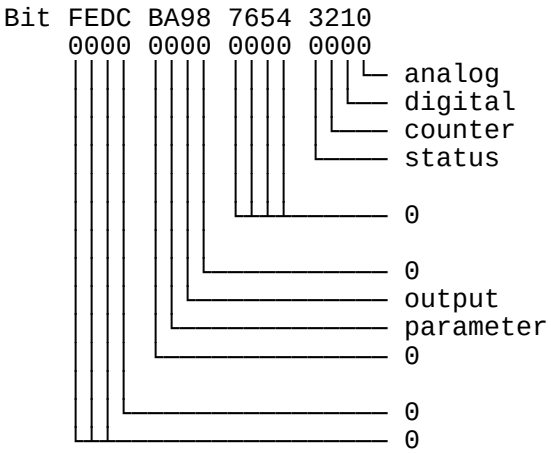
This command makes possible the data transmission to any desired Sunny Net participant. Herewith parameters, counter values, digital outputs and operation states (status) can be set. The data content is structured according to the transmission mask. This mask is identical with the channel type definition of the respective (measuring) channels. A Sunny Net participant answers with an Acknowledge at correct transmission.

Request:

Cmd: 12

Ctrl: 00000000 b

Data content: transmission mask (word)



channel no. (byte)

= 0 ⇒ all channels acc. to mask

> 0 ⇒ only one channel (acc. to channel no.)

data set (to be calculated)

Length: 3-byte + ??? + 16 Bytes for frame

Time of transm.: 158 ms (incl. frame + syncbytes at 1200 baud)

Source address: Sunny Data network address

destination addr. SWR network address

Example: analog channel set from 2 to 160V

Sync	Sync	start	length	length	start	source	destination	Ctrl	PkCnt	Cmnd
AA	AA	68	09	09	68	00 00	01 00	00	00	0C

user data transm mask	user data channel no.	user data data format	user data	CS	stop
Para+ Analog			=160		
01 04	02	01 00	00 00 20 43	78 00	16

Response:

Cmd: 12

Ctrl: 01000000 b

Data content: -

Length: 5 + 16 Bytes for frame

Time of transm.: 183 ms (incl. frame + syncbytes at 1200 baud)

Example:

Sync	Sync	start	length	length	start	source	destination	Ctrl	PkCnt	Cmnd
AA	AA	68	05	05	68	01 00	00 00	40	00	0C

user data transm.mask	user data channel no.	user data data format	CS	stop
Para+ Analog				
01 04	02	01 00	55 00	16

5 Sunny Data Example Programs

In order to simplify the design of own PC programs there is a support disc with example programs available. It contains the following files:

main.exe	DOS-program in order to test the communication
/src/prtl2.pas	protocol level 2
/src/prtl7.pas	protocol level 7
/src/prttyp.pas	used data types