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RS485 communication protocol

Communication between inverter and data logger

Abstract

This document describes the properties and the structure of the RS485 communication protocols for solar inverters from KACO new energy. All definitions refer to the communication between inverter and data logger.

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1 Overall protocol properties

The data logger assumes the Master function, whereas the inverters will act as slaves. Transmission is in the ASCII format.

1.1 Valid inverter series

Table 1: Inverter series form KACO new energy

Inverter series	Product name
"00" (before "00xi")[1]	Powador 2500xi … 8000xi | Powador 4000 supreme … 8000 supreme Powador 3200 … 9600 | Powador 5300 supreme … 9600 supreme blueplanet 6400xi supreme/ 7600xi supreme
"02" (before "00xi")[1]	Powador 1501xi … 5001xi Powador 2002 … 6002 blueplanet 1501xi/ 2901xi/ 3601 xi blueplanet 1502xi … 5002xi
"000xi"	Powador 25000xi/ 30000xi/ 33000xi/ 25000xi Park/ 30000xi Park/ 33000xi Park
"XP"	Powador XP100-HV/ XP200-HV/ XP200-HV TL/ XP250-HV/ XP250-HV TL/ XP350-HV TL blueplanet XP100U-H2/ blueplanet XP100U-H4
"TL3"	Powador 6.0-18.0 TL3 / Powador 30-72.0 TL3 / blueplanet 32.0-50.0 TL3
"TR3"	Powador 16.0-18.0 TR3

1.2 Overview communication protocols

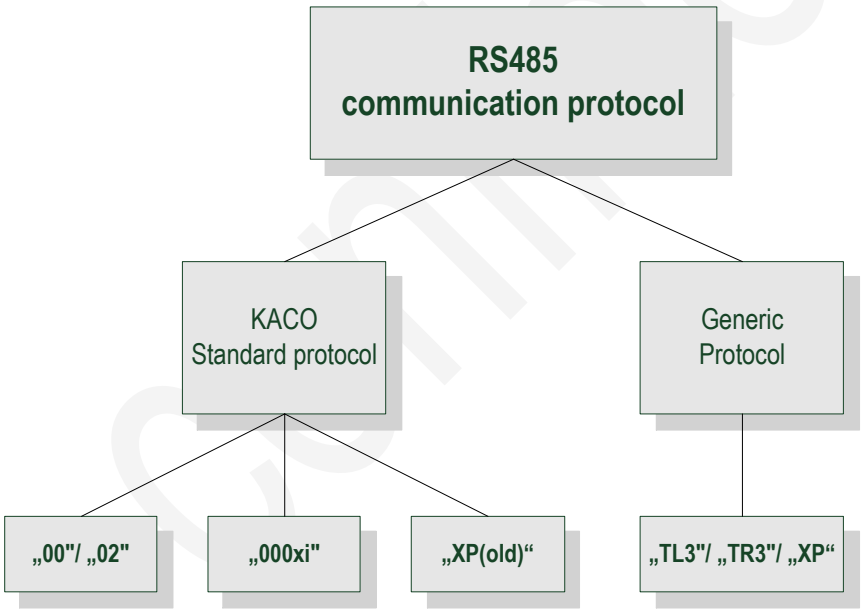


Figure 1: Overview KACO communication protocols

[1] The protocol properties of the „xi" series and the new series are the same

1.3 Parameters and basic conditions

- There are 32 subscribers allowed.
- All KACO new energy inverters have an address range of 1…32; zero is not allowed.
- Data logger, hub and other devices are also subscribers, but they don't have an address!
- The scanning cycle of the data logger must not be under one second.

Table 2: Connection settings

Connection settings	Value
Baudrate	9600 baud
Data bits	8
Parity	none
Stop bits	1
Flow control	none

1.4 Commands

The following functions are provided for communication:

Command format "zxxy<CR>"
z Query = "#" and reply = "*"
xx Inverter address 1…32
y Remote command

Remote command y as query of data logger
0 Query for inverter series
9 Query for inverter type

Remote command y as reply of inverter
0 Identification as inverter series "00"/ "02"/ "XP(old)"[2]
4 Identification as inverter series "000xi"
n Identification as inverter series "TL3"/ "TR3"/ "XP"
9 Output of inverter type

Table 3: Overview of the implemented remote commands by inverter series

Inverter series	Query data logger	Reply of inverter	Explanation
"00"/ "02"/ "XP(old)"[2]	#xx0<CR>	<LF>*xx0 4 390.1 2.84 …	Data output of inverter
"000xi"	#xx0<CR>	<LF>*xx4<CR>	Reply for recognition a 000xi
	#xx1<CR>	<LF>*xx1 4 423.4 1.26 …	Data output of inverter unit 1
	#xx2<CR>	<LF>*xx2 4 429.2 1.22 …	Data output of inverter unit 2
	#xx3<CR>	<LF>*xx3 4 409.0 1.09 …	Data output of inverter unit 3
"TL3"/ "TR3"/ "XP"	**#xx0<CR>**	<LF>*xxn 23 160TR 4 52.5…	Data output of inverter
"02" / "XP"	#xx9<CR>	<LF>*xx9 3002IN ¿<CR>	Output of inverter type, with checksum

[2] Powador XP inverters with KACO Standard Protocol (all previous version including MMI software version 1.33)

2 KACO Standard protocol

2.1 Frame properties in general

- There is a fixed quantity of nine measured values (e.g. U, PN …) before the checksum “F” defined.
- The order of the measured values is fixed, see table 4 of the measured value symbols.
- The blank is defined as the separator between the measured values.
- The quantity of digits of a measured value is fixed, see table 4.
- Has a measured value at the moment of transmission less than the defined quantity of digits, then the remaining digits were filled with blanks (“ 00”/ “02”/ “000xi”) or zeros (“XP”).
- The inverter type (type for short) is transmitted after the checksum “F”.
- The type is limited to seven digits, one blank inclusive.

2.2 Structure of telegram and definition of measured values

In the examples below, the blank characters for separation have been replaced with dashes “-“. The functional characters (“LF”, “CR”) which stand for line beginning and line end are shown in plaintext.
The query of the data logger continues with

#<ADR>0<CR>

The following data is output by the inverters:

Series “00”/ “02”
Example inverter reply

```
 ST1  A    S    V    I       P    UN    IN    PN  T      E  F    WR ST2
<LF>*030---4-355.9--2.92--1039-239.5--4.12---974--40---3229-«-5000xi<CR>
```

Series “000xi”
Example inverter reply

```
 ST1  A   S     V    I       P    UN    IN     PN  T     E   F  WR ST2
<LF>*121---4-440.6--1.54----678-240.5--2.58----617-42--13024-¿-10k1<CR>
<LF>*122---4-440.9--1.50----661-239.7--2.26----560-42--12174-¾-10k2<CR>
<LF>*123---4-400.8--1.44----577-242.0--2.26----552-41--12003---10k3<CR>
```

Series “XP(old)”
Example inverter reply

```
ST1   A   S     V     I      P    UN    IN     PN    T     E    F   WR      G     ST2
<LF>*120--35-619.8-124.90-015400-414.0-019.10-013400-19-0018700-a-100kTR-000008645<CR>
```

Table 4: Explanation of symbols of the measured values

Symbol	Description	Number of digits with decimal point (post-decimals of them)			Unit
		“00”/ “02”	“000xi”	“XP(old)”	
ST1	LF = LineFeed	1 (0)	1 (0)	1 (0)	-
A	Reply sign “*” & address & remote command	4 (0)	4 (0)	4 (0)	-
S	Status	3 (0)	3 (0)	3 (0)	-
V	Generator voltage	5 (1)	5 (1)	5 (1)	V
I	Generator current	5 (2)	5 (2)	6 (2)	A
P	Generator power	5 (0)	6 (0)	6 (0)	W
UN	Grid voltage	5 (1)	5 (1)	5 (1)	V
IN	Grid- / Grid-feeding current	5 (2)	5 (2)	6 (2)	A
PN	Delivered (fed-in) power	5 (0)	6 (0)	6 (0)	W
T	Device temperature	3 (0)	2 (0)	2 (0)	°C
E	Daily yield	6 (0)	6 (0)	7 (0)	Wh
F	Checksum (1 byte)	1 (0)	1 (0)	1 (0)	-
WR	Inverter type, abbreviation	6 (0)	4 (0)	6 (0)	-

G	Total yield	0 (0)	0 (0)	9 (0)	kWh
ST2	CR = Carriage Return	1 (0)	1 (0)	1 (0)	-

At least one blank is used as a separator between two measured values. The measured values are right-aligned and shown in a fixed place; the inverter type FOLLOWING the checksum. The inverter type follows the checksum and a separator. It always contains six data digits. The inverter type must consist of the printable characters 0 …9/a…z / A…Z and blanks. If it contains less than six printable characters 00H bytes are used for padding. The measured values are transmitted without their description and unit. The output sequence of the values is fixed and can be seen from the table above.
Please note the following in connection with "energy" values: the inverter always returns a value for the daily yield "E". The XP inverters transmit additionally the added energy as total yield "G".

To obtain the checksum, the ASCII values of the " * " characters of a row are added, up to and including the blank character after the yield. These calculated checksum byte can contain values of 0.. 255 and in the adverse case also linefeed (10), carriage return (13) or other control values. Due to the range of values also non-printable characters are included, which can be printed differently at the receiver. The real value of the byte must be used for the processing. To calculate the checksum, only 1 byte is used for adding and displaying (thus including the arithmetic overflow).

2.3 Command to read the total yield

Command from PC

#<ADR>3<CR>

Series "00"/ "02"
Example inverter reply (**not 30kW**)

```
 ST1  A   D1     D2    D3       D4     D5         D6         D7        ST2
<LF>*xx3 12345 123456 123456 123456 123456:78 123456:78 123456:78 <CR>
```

Symbol	Description	Number of digits with decimal point	Unit
ST1	LF = LineFeed	1	-
A	Reply sign "*" & address & remote command	3	-
D1	AC-daily yield (peak)	5	W
D2	Daily yield	6	kWh***10**
D3	Short-time-counter	6	kWh***10**
D4	Total yield	6	kWh***10**
D5	Daily yield hours	8	hhhhhh:mm
D6	Short time counter	8	hhhhhh:mm
D7	Total yield hours	8	hhhhhh:mm
ST2	CR = Carriage Return	1	-

3 Generic Protocol

3.1 In general

Because of the new three-phase inverters with multiple MMP trackers, multitude and variation of values the need for a more flexible protocol arose.
The solution is the new Generic Protocol. The biggest difference to the KACO Standard Protocol is the flexible length and structure of the payload. For the first time, the length of the replay telegram is flexible. The length, position and amount of digits of the measured values depends on the inverter type and will match with the requirements of the inverter. As a result a fast query of all measured values is guaranteed for all new inverter types.

The communication protocol of the inverter series “00”, “02” and “000xi” remains. The distinction between the protocols is recognized with the inverter reply. The command “0” for the KACO Standard Protocol and “n” for the new Generic Protocol. Furthermore all Powador XP inverters with the MMI software starting from version 1.34 have also implemented the new protocol.
The query from the data logger will stay the same:

```
#<ADR>0<CR>
```

3.2 Structure of the telegram and definition of the measured values

No.	I	II	III	IV	1	2	3	4	5	...	...	...	NOE - 2	NOE - 1	NOE	NOE + 1	NOE + 2
Bytes	1	1	2	1	var	var	var	var	var	...	...	...	var	var	var	4	1
Term	LF	*	ADR	CMD	NOE	TYP	STA	Payload								Checksum	CR

For separation among the fields there is one blank between.

Term	Meaning	Explanation
LF	Line Feed	Start of the telegramm
*****	Reply start character	Start of reply
ADR	Address	Inverter adress
CMD	Command	Remote command „y=n“
NOE	Number of elements (n)	Amount of elements i a telegram (specific to inverter). The NOE is the sum of: NOE = [NOE] + [TYP] + [STA] + [PYL]. Example: With 10 measured values is NOE=13.
TYP	Type	Inverter type of an inverter series. See also type allocation.
STA	Status	Current status of the inverter.
PYL	Payload (Nutzdaten)	Total of all sent measured values from the inverter
CHK	Checksum (CRC16)	The checksum includes four ASCII digits (HEX) and no functional characters like “LF” and “CR”. The calculation of the CRC starts at “*” and ends at the last blank after the last measured value. The following generating polynomial is used: KACO_CRC16 = ~Calculated_CRC16 & 0xffff;
CR	Carriage return	End of telegram

3.3 Calculation of CRC in Generic Protocol

This abstract describes detailed facts about the calculation of the CRC in Generic Protocol.

KACO_CRC16 = ~Calculated_CRC16 & 0xffff;

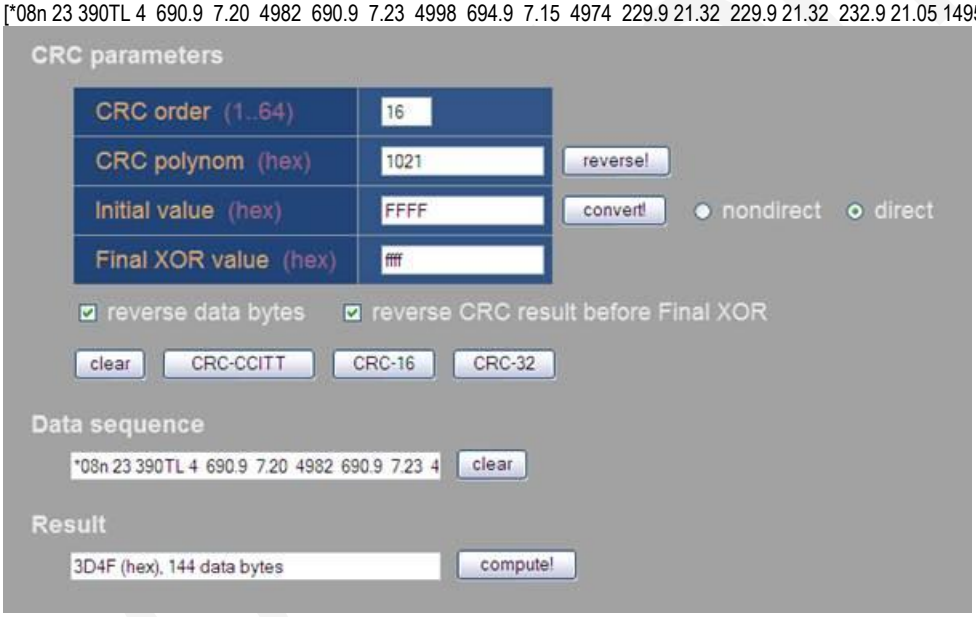
1. "0x8408" (HEX) - $x^{16} + x^{12} + x^5 + 1$
2. after the calculation follows a bit by bit inverting
3. beginning value "0xffff" (HEX) is used after the inverting to limit the variable type to 16 bit

Here a simple example if the CRC is bigger than 16 bit.
0xABCDF
& 0xFFFF
= 0xBCDF

With this web page you should comprehend the calculation easily.
http://zorc.breitbandkatze.de/crc.html

Below a screenshot with the parameters.
Whole Telegram:
<LF>*08n 23 390TL 4 690.9 7.20 4982 690.9 7.23 4998 694.9 7.15 4974 229.9 21.32 229.9 21.32 232.9 21.05 14955 14715 0.993c 40.0 69 3D4F<CR>

„Data squence" copied in the data sequence field:
[*08n 23 390TL 4 690.9 7.20 4982 690.9 7.23 4998 694.9 7.15 4974 229.9 21.32 229.9 21.32 232.9 21.05 14955 14715 0.993c 40.0 69]



Please note:
Activate "reverse data bytes", "reverse CRC result before Final XOR" and put in the parameters as follows:

Parameter	Value
Width	16
Poly	1021
Init	FFFF
RefIn	True
RefOut	True
XorOut	FFFF

3.3.1 Payload of Powador 16.0-18.0 TR3

Example of an inverter reply:

```
<LF>*<ADR>n 23 160TR 12 1234.5 12.34 12345 1234.5 12.34 12345 1234.5 12.34 12345 1234.5 12.34
1234.5 12.34 1234.5 12.34 12345 12345 0.999c 123.4 123456 ABCD<CR>
```

Field no.	Symbol	Sample data	Unit	Explanation
4	U_{DC1}	1234.5	V	DC- Voltage 1 of MPPT1
5	I_{DC1}	12.34	A	DC- Current 1 of MPPT1
6	P_{DC1}	12345	W	DC- Power 1 of MPPT1
7	U_{DC2}	1234.5	V	DC- Voltage 2 of MPPT2
8	I_{DC2}	12.34	A	DC- Current 2 of MPPT2
9	P_{DC2}	12345	W	DC- Power 2 of MPPT2
10	U_{DC3}	1234.5	V	DC- Voltage 3 of MPPT3
11	I_{DC3}	12.34	A	DC- Current 3 of MPPT3
12	P_{DC3}	12345	W	DC- Power 3 of MPPT3
13	U_{AC1}	1234.5	V	AC- Voltage 1 of phase 1
14	I_{AC1}	12.34	A	AC- Current 1 of phase 1
15	U_{AC2}	1234.5	V	AC- Voltage 2 of phase 2
16	I_{AC2}	12.34	A	AC- Current 2 of phase 2
17	U_{AC3}	1234.5	V	AC- Voltage 3 of phase 3
18	I_{AC3}	12.34	A	AC- Current 3 of phase 3
19	P_{DC}	12345	W	DC- Power total
20	P_{AC}	12345	W	AC- Power total
21	cosφ	0.999c	-	Cos phi
22	T	123.4	°C	Circuit board temperature
23	E_{day}	123456	Wh	Daily yield

3.3.2 Payload of Powador 6.0-18.0 TL3

Example of an inverter reply:

```
<LF>*<ADR>n 20 100TL 12 1234.5 12.34 12345 1234.5 12.34 12345 1234.5 12.34 1234.5 12.34  1234.5
12.34 12345 12345 0.999c 123.4 123456 ABCD<CR>
```

Field no.	Symbol	Sample data	Unit	Explanation
4	U_{DC1}	1234.5	V	DC- Voltage 1 of MPPT1
5	I_{DC1}	12.34	A	DC- Current 1 of MPPT1
6	P_{DC1}	12345	W	DC- Power 1 of MPPT1
7	U_{DC2}	1234.5	V	DC- Voltage 2 of MPPT2
8	I_{DC2}	12.34	A	DC- Current 2 of MPPT2
9	P_{DC2}	12345	W	DC- Power 2 of MPPT2
10	U_{AC1}	1234.5	V	AC- Voltage 1 of phase 1
11	I_{AC1}	12.34	A	AC- Current 1 of phase 1
12	U_{AC2}	1234.5	V	AC- Voltage 2 of phase 2
13	I_{AC2}	12.34	A	AC- Current 2 of phase 2
14	U_{AC3}	1234.5	V	AC- Voltage 3 of phase 3
15	I_{AC3}	12.34	A	AC- Current 3 of phase 3
16	P_{DC}	12345	W	DC- Power total
17	P_{AC}	12345	W	AC- Power total
18	cosφ	0.999c	-	Cos phi
19	T	123.4	°C	Circuit board temperature
20	E_{day}	123456	Wh	Daily yield

3.3.3 Payload of Powador 30-72.0 TL3 and TL3 M3-Types

Example of an inverter reply:

```
<LF>*<ADR>n 23 300TL 12 1234.5 12.34 12345 1234.5 12.34 12345 1234.5 12.34 12345 1234.5 12.34
1234.5 12.34 1234.5 12.34 12345 12345 0.999c 123.4 123456 ABCD<CR>
```

Field no.	Symbol	Sample data	Unit	Explanation
4	U_{DC1}	1234.5	V	DC- Voltage 1 of MPPT1
5	I_{DC1}	12.34	A	DC- Current 1 of MPPT1
6	P_{DC1}	12345	W	DC- Power 1 of MPPT1
7	U_{DC2}	1234.5	V	DC- Voltage 2 of MPPT2
8	I_{DC2}	12.34	A	DC- Current 2 of MPPT2
9	P_{DC2}	12345	W	DC- Power 2 of MPPT2
10	U_{DC3}	1234.5	V	DC- Voltage 3 of MPPT3
11	I_{DC3}	12.34	A	DC- Current 3 of MPPT3
12	P_{DC3}	12345	W	DC- Power 3 of MPPT3
13	U_{AC1}	1234.5	V	AC- Voltage 1 of phase 1
14	I_{AC1}	12.34	A	AC- Current 1 of phase 1
15	U_{AC2}	1234.5	V	AC- Voltage 2 of phase 2
16	I_{AC2}	12.34	A	AC- Current 2 of phase 2
17	U_{AC3}	1234.5	V	AC- Voltage 3 of phase 3
18	I_{AC3}	12.34	A	AC- Current 3 of phase 3
19	P_{DC}	12345	W	DC- Power total
20	P_{AC}	12345	W	AC- Power total
21	cosφ	0.999c	-	Cos phi
22	T	123.4	°C	Circuit board temperature
23	E_{day}	123456	Wh	Daily yield

3.3.4 Payload of Powador XP100-350 and TL3 M1-Types

Example of an inverter reply:

```
<LF>*<ADR>n 16 100kTR 130 12345 1234.5 12345 12.34 12345 12.34 12345 12.34 12345 12345 0.999c 12.3
1234567 ABCD<CR>
(Status Messages XP)
<LF>*<ADR>n 16 50kH4P 12 1234.5 12.34 1234.5 12.34 1234.5 12.34 1234.5 12.34 12345 12345 0.999c
123.4 123456 ABCD<CR>
(Status Messages Tx3)
```

Field no.	Symbol	Sample data	Unit	Explanation
4	U_{DC1}	12345	V	DC- Voltage
5	I_{DC1}	1234.5	A	DC- Current
6	U_{AC1}	12345	V	AC- Voltage 1
7	I_{AC1}	12.34	A	AC- Current 1
8	U_{AC2}	12345	V	AC- Voltage 2
9	I_{AC2}	12.34	A	AC- Current 2
10	U_{AC3}	12345	V	AC- Voltage 3
11	I_{AC3}	12.34	A	AC- Current 3
12	P_{DC}	12345	W	DC- Power
13	P_{AC}	12345	W	AC- Power
14	cosφ	0.999c	-	Cos phi
15	T	12.3	°C	Circuit board temperature
16	E_{day}	1234567	Wh	Daily yield

3.4 Command to read the total yield

Command from PC

#<ADR>3<CR>

Series "Tx3"
Example inverter reply (**not 30kW**)

ST1	A	D1	D2	D3	D4	D5	D6	D7	ST2
<LF>*	xx3	12345	123456	123456	123456	123456:78	123456:78	123456:78	<CR>

Symbol	Description	Number of digits with decimal point	Unit
ST1	LF = LineFeed	1	-
A	Reply sign "*" & address & remote command	3	-
D1	AC-daily yield (peak)	5	W
D2	Daily yield	6	Wh
D3	Short-time-counter	6	Wh
D4	Total yield	6	Wh
D5	Daily yield hours	8	hhhhhh:mm
D6	Short time counter	8	hhhhhh:mm
D7	Total yield hours	8	hhhhhh:mm
ST2	CR = Carriage Return	1	-

3.5 Command to read the serial number

#<ADR>s<CR>

ST1	A	D1	D2	ST2
<LF>*	xxs	58267	02B6	<CR>

Symbol	Description	Number of digits with decimal point	Unit
ST1	LF = LineFeed	1	-
A	Reply sign "*" & address & remote command	3	-
D1	Serial Number String	1..30	-
D2	Checksum KACO_CRC16	4	-
ST2	CR = Carriage Return	1	-

3.6 Command to read the inverter temperature

Not for TX-3 inverters

#<ADR>5<CR>

ST1	A	D1	D2	ST2
<LF>*	xx5	T KK=000	T ST=026	<CR>

Symbol	Description	Number of digits with decimal point	Unit
ST1	LF = LineFeed	1	-
A	Reply sign "*" & address & remote command	3	-
D1	Temperature on the heat sink	3	-
D2	Temperature on the control board	3	-
ST2	CR = Carriage Return	1	-

3.7 Command to delete the inverter internal energy meter

#<ADR>7<CR>

ST1	A	ST2
<LF>*	xx7	<CR>

Symbol	Description	Number of digits with decimal point	Unit
ST1	LF = LineFeed	1	-
A	Reply sign "*" & address & remote command	3	-
ST2	CR = Carriage Return	1	-

3.8 Command to read the software version ARM and DSP

#<ADR>8<CR>

	ST1	A	D1	D2	D3	D4	D5	D6	D7	D8	D9	ST2
00/02	<LF>*	xx8	ARM	V4.05	3775	Config	V6.06	1DAE	DSP	V3.40	D58B	<CR>
Tx3	<LF>*	xx8	ARM	V1.46	2E5C	Config	V1.00		DSP	V1.28	6FFF	<CR>
Tx3 ab ARM V1.60	<LF>*	xx8	ARM	V1.60	4D7D	Config	V5.0106	D278	DSP	V1.30	9A7B	<CR>

Symbol	Description	Number of digits with decimal point	Unit
ST1	LF = LineFeed	1	-
A	Reply sign "*" & address & remote command	3	-
D1	Type = ARM application	3	-
D2	Software Version	5	-
D3	Checksum of the Software	4	-
D4	Type = Configuration	6	-
D5	Software Version	5 or 7	-
D6	Checksum of the Software	0 or 4	-
D7	Type = DSP application	3	-
D8	Software Version	5	-
D9	Checksum of the Software	4	-
ST2	CR = Carriage Return	1	-

3.9 Command to read the inverter type

#<ADR>9<CR>

ST1	A	D1	D2	ST2
<LF>*	xx9	SG8002	h	<CR>

Symbol	Description	Number of digits with decimal point	Unit
ST1	LF = LineFeed	1	-
A	Reply sign "*" & address & remote command	3	-
D1	Inverteype String	1..6	-
D2	1 Byte checksum	1	-
ST2	CR = Carriage Return	1	-

4 Type allocations

4.1 Transformerless string inverters

Type	Indication	Pmax [W]	Comment
2500xi	Powador 2500xi	2850	
3000xi	Powador 3000xi	2850	Only in France
3500xi	Powador 3500xi	3800	
3600xi	Powador 3600xi	4000	
4000xi	Powador 4000xi	4800	
4500xi	Powador 4500xi	5060	
5000xi	Powador 5000xi	6000	For Spain with Pmax = 5500 W
6400xi	Powador 6400xi	6400	
6650xi	Powador 6650xi	6650	
7200xi	Powador 7200xi	7200	
8000xi	Powador 8000xi	8000	
4000su	Powador 4000 supreme	4800	
6400su	Powador 6400 supreme	6400	
6650su	Powador 6650 supreme	6650	
7200su	Powador 7200 supreme	7200	
8000su	Powador 8000 supreme	8000	
3200I	Powador 3200	2850	International version
4200I	Powador 4400	3450	International version
4400I	Powador 4400	4000	International version
5300I	Powador 5300	4800	International version
5500I	Powador 5500	5060	International version
6600I	Powador 6600	6000	International version
7700I	Powador 7700	6400	International version
7900I	Powador 7900	6650	International version
8600I	Powador 8600	7200	International version
9600I	Powador 9600	8000	International version
5300IS	Powador 5300 supreme	4800	International version
7700IS	Powador 7700 supreme	6400	International version
7900IS	Powador 7900 supreme	6650	International version
8600IS	Powador 8600 supreme	7200	International version
9600IS	Powador 9600 supreme	8000	International version

4.2 Galvanically isolated inverters

Type	Indication	Pmax [W]	Comment
1501xi	Powador 1501xi	1650	
2501xi	Powador 2501xi	2750	Only for France
3501xi	Powador 3501xi	3600	
4501xi	Powador 4501xi	5060	
5001xi	Powador 5001xi	5100	
2002DE	Powador 2002	1650	German version
3002DE	Powador 3002	2500	German version
4202DE	Powador 4202	3500	German version
5002DE	Powador 5002	4200	German version
6002DE	Powador 6002	4600	German version
2002IN	Powador 2002	1650	International version
3002IN	Powador 3002	2500	International version
4202IN	Powador 4202	3500	International version
5002IN	Powador 5002	4200	International version
6002IN	Powador 6002	5000	International version
3000IN	Powador 3000 SE	2800	Only for France and Italy

4.3 Transformerless three-phase inverters

Type	Indication	Pmax [W]	Comment
8k1	Powador 25000xi/1		Inverter unit 1
8k2	Powador 25000xi/2		Inverter unit 2
8k3	Powador 25000xi/3		inverter unit 3
3x8k	Powador 25000xi	27500	Total inverter
10k1	Powador 30000xi/1		Inverter unit 1
10k2	Powador 30000xi/2		Inverter unit 2
10k3	Powador 30000xi/3		inverter unit 3
3x10k	Powador 30000xi	32900	Total inverter
11k1	Powador 33000xi/1		Inverter unit 1
11k2	Powador 33000xi/2		Inverter unit 2
11k3	Powador 33000xi/3		inverter unit 3
3x11k	Powador 33000xi	33300	Total inverter
60TL	Powador 6.0 TL3	5000	Only Generic Protocol
78TL	Powador 7.8 TL3	6500	Only Generic Protocol
90TL	Powador 9.0 TL3	7500	Only Generic Protocol
100TL	Powador 10.0 TL3	9000	Only Generic Protocol
120TL	Powador 12.0 TL3	10000	Only Generic Protocol
140TL	Powador 14.0 TL3	12000	Only Generic Protocol
180TL	Powador 18.0 TL3	15000	Only Generic Protocol
300TL	Powador 30.0 TL3	25000	Only Generic Protocol
330TL	Powador 33.0 TL3	27500	Only Generic Protocol
360TL	Powador 36.0 TL3	30000	Only Generic Protocol
375TL	Powador 37.5 TL3	30000	Only Generic Protocol
390TL	Powador 39.0 TL3	33300	Only Generic Protocol
400TL	Powador 40.0 TL3	36000	Only Generic Protocol
480TL	Powador 48.0 TL3	40000	Only Generic Protocol
600TL	Powador 60.0 TL3	49900	Only Generic Protocol
720TL	Powador 72.0 TL3	60000	Only Generic Protocol

Comment: The total inverter of the 000xi types are not applied, only the type of the inverter unit.

4.4 Galvanically isolated three-phase inverters

Type	Indication	Pmax [W]	Comment
160TR	Powador 16.0 TR3	13500	Only Generic Protocol
180TR	Powador 18.0 TR3	15000	Only Generic Protocol

4.5 Central inverters

Type	Indication	Pmax [W]	Explanation
100kTR	Powador XP100-HV	100.000	Standard & Generic Protocol
200kTR	Powador XP200-HV	200.000	Standard & Generic Protocol
200kTL	Powador XP200-HV TL	200.000	Standard & Generic Protocol
250kTR	Powador XP250-HV	250.000	Standard & Generic Protocol
250kTL	Powador XP250-HV TL	250.000	Standard & Generic Protocol
350kTL	Powador XP350-HV TL	350.000	Standard & Generic Protocol

4.6 KACO blueplanet North America / Canada

Type	Indication	Pmax [W]	Explanation
1501xi	Powador 1501xi	1.650	Only North America (blueplanet 1501xi)
2901xi	blueplanet 2901xi	3.500	Only North America
3601xi	blueplanet 3601xi	4.400	Only North America
1502xi	blueplanet 1502xi	1.650	Only North America
2502xi	blueplanet 2502xi	2.500	Only North America
3502xi	blueplanet 3502xi	3.500	Only North America
5002xi	blueplanet 5002xi	5.000	Only North America
6400u	blueplanet 6400xi supreme	6.400	Only North America
7600u	blueplanet 7600xi supreme	7.600	Only North America
6400UM	blueplanet 6400M	6.400	Only North America
7600UM	blueplanet 7600M	7.600	Only North America
10kH4	blueplanet XP10U-H4	10.000	Only North America / Generic Protocol
10kH6	blueplanet XP10U-H6	10.000	Only Canada / Generic Protocol
100kH2	blueplanet XP100U-H2	100.000	Only North America
100kH4	blueplanet XP100U-H4	100.000	Only North America
83kH6	blueplanet XP83U-H6	83.000	Only Canada
90kH6	blueplanet XP90U-H6	90.000	Only Canada
100kH6	blueplanet XP100U-H6	100.000	Only Canada

4.7 KACO blueplanet TL3 M1 OD

Type	Indication	Pmax [W]	Explanation
32kH4P	KACO blueplanet 32.0 TL3 M1 OD	32.000	Only North America / Generic Protocol
40kH4P	KACO blueplanet 40.0 TL3 M1 OD	40.000	Only North America / Generic Protocol
50kH4P	KACO blueplanet 50.0 TL3 M1 OD	50.000	Only North America / Generic Protocol

4.8 KACO blueplanet TL3 M3 OD

Type	Indication	Pmax [W]	Explanation
32kH4	KACO blueplanet 32.0 TL3 M3 OD	32.000	Only North America / Generic Protocol
40kH4	KACO blueplanet 40.0 TL3 M3 OD	40.000	Only North America / Generic Protocol
50kH4	KACO blueplanet 50.0 TL3 M3 OD	50.000	Only North America / Generic Protocol