



## Description of the MaxComm data protocol for communication with SolarMax products using the MaxComm interface

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## Protocol description

### 1.1 Structure

The protocol is structured as follows:

|       |         |    |          |    |        |     |      |    |      |       |     |            |
|-------|---------|----|----------|----|--------|-----|------|----|------|-------|-----|------------|
| STX   | Src-Add | FS | Dest-Add | FS | Length | FRS | Port | US | Data | FRS   | Crc | ETX or ETB |
| FRAME |         |    |          |    |        |     | DATA |    |      | FRAME |     |            |

|          | Meaning   | Character / value | ASCII value (dec) |
|----------|---|-------------------|-------------------|
| STX      | Start of Text; indicates the start of a data packet   | {                 | 123               |
| ETX      | End of Text; indicates the end of a data packet if no further packets associated with this transmission follow    | }                 | 125               |
| ETB      | End of Text Block; indicates the end of a data packet if further packets associated with this transmission follow | )                 | 41                |
| FRS      | Frame Separator; indicates start / end of frame data  |                   | 124               |
| US       | Union Separator; separator between unions   | :                 | 58                |
| FS       | Field Separator; separator for fields within a union  | ;                 | 59                |
| Src-Add  | Address of the sending device   | 00 ... FF         |                   |
| Dest-Add | Address of the target device  | 00 ... FF         |                   |
| Length   | Length of all characters of the data packet   | 00 ... FF         |                   |
| Crc      | Sum of the ASCII values of all characters from the address up to and including the FRS, before the Crc            | 0000 ... FFFF     |                   |
| Port     | Port number for determining the target or the origin of the user data   | 0 ... FFFF        |                   |
| Data     | User data, see description below  |                   |                   |

The transfer rate is 19,200 bps. The protocol is 8 data bits, no parity, 1 stop bit (8N1).

The maximum length of a data packet is 255 bytes. If the volume of data exceeds the length of a packet, several packets will be generated, each ending with ETB. The devices listed in Section 3.4 can send (but not receive) multiple packets.

All numeric values are encoded as ASCII characters in hexadecimal form.

A data packet ending with ETX never has a US or FS before the FRS.

Src-Address, Dest-Address and Length are always two ASCII characters long, Crc is always four ASCII characters long.

### 1.2 Timing

The MaxComm communication protocol is based on the master-slave principle. The SolarMax devices do not send data spontaneously, but only in response to queries from the master. Only one device at a time may be polled. The next device can only be polled once a response has been received from the previously polled device or the response timeout has elapsed.

The maximum response time depends on the number of queried values:

- typical response time: 300 ms

- maximum response time (timeout): 3000 ms

### 1.3 Addressing

The `Src-Add` field contains the device address of the data packet source. The `Dest-Add` field contains the address of the device for which the data packet is intended. There are several predefined addresses which cannot be assigned to SolarMax devices.

| Address (dec) | Designation    | Description  |
|---------------|----------------|--|
| 0             | Broadcast      | The <b>Broadcast</b> address can only occur as a destination address. All devices connected to the bus respond to it. It may <b>only be used for point-point connections</b> . |
| 250           | Network master | The address of the network master (MaxComm Basic, MaxWeb).   |
| 251           | Host           | The address of an alternative network master that is connected in addition to the network master. <sup>1)</sup>  |
| 252           | MaxDisplay     | Reserved address for large displays with the MaxDisplay interface.   |
| 253           | reserved       | -  |
| 254           | reserved       | -  |
| 255           | Uninitialized  | Default value for non-configured network nodes   |

<sup>1)</sup> In each case the system must ensure that only one query at a time is sent to a device, see Section 1.2.

The address range of the MaxComm protocol is 0 (0x00) to 255 (0xFF). Each address may only occur once in the network. For SolarMax devices, addresses between 1 and 249 can be used. In respect of SolarMax devices, the network address is set either via their display or a DIP switch.

### 1.4 Port number

The port number can be used to determine the destination or source of user data. Different ports are available, depending on the network node type:

| Port number (dec) | Meaning                     |
|-------------------|-----------------------------|
| 100               | User data                   |
| 200               | Setting / command           |
| 1000              | Messages from the interface |

### 1.5 Messages from the interface

If data cannot be interpreted by the network node, the device returns a message with port number 1000. The following messages are possible:

| Key | Meaning  |
|-----|--|
| IPR | Invalid Protocol: Error in checksum or length / transmission error |
| IPN | Invalid Port Number: The selected port is not served               |

Example:

Host sends: {FB;2A;<Length>|1F4:TYP|<Crc>}

Network node responds: {2A;FB;<Length>|3E8:IPN|<Crc>}

The network nodes do not detect any error messages from the host.

## 1.6 Messages from devices

If data cannot be interpreted by the device, either because the device doesn't support the key, or the key is not applicable at this moment, the device will send back a message with a missing key or a key without value.

### 1.6.1 Key not supported

If the device does not support the key, it will send back a message with the key missing.

Example:

Host sends:                    {FB;2A;<Length>|1F4:TYP|<Crc>}

Device responds:            {2A;FB;<Length>|1F4:|<Crc>}

### 1.6.2 Key not applicable

If the device generally supports the key, but due to specific settings the key can not be applied at this moment, the device will simply send back the key without any value.

Example:

Host sends:                    {FB;2A;<Length>|1F4:TYP|<Crc>}

Device responds:            {2A;FB;<Length>|1F4:TYP|<Crc>}

## 2 Data query

### 2.1 Query format

In order to retrieve data, a list containing the keys for the required values must be sent to the network node. A port number of 100 (0x64) is used for user data. Example:

```
{FB;2A;<Length>|64:TYP;SWV;UDC|<Crc>}
```

returns the values for TYPE (type), SWV (software version) and UDC (DC voltage) in the following form:

```
{2A;FB;<Length>|64:TYP=7D0;SWV=28;UDC=180|<Crc>}
```

Undefined keys are ignored in the response.

The requested data will only be transferred once.

No spaces may be used between a key and the preceding FS or the following FS.

The keys are case-sensitive.

## 2.2 Network variable

The transmitted user data are formatted based on standardised network variables. Each data key is assigned a network variable containing information about the formatting of the data key value. The following network variables are currently defined:

| Name of network variable | Unit   | Size                    | Offset / zero point | Resolution per digit | Minimum value | Maximum value   |
|--------------------------|--------|-------------------------|---------------------|----------------------|---------------|-----------------|
| Voltage_1                | V      | 16 bit                  | 0                   | 0.001                | 0             | 65.5350         |
| Voltage_2                | V      | 16 bit                  | 0                   | 0.1                  | 0             | 6553.5000       |
| Current_positive_1       | A      | 16 bit                  | 0                   | 0.0001               | 0             | 6.5535          |
| Current_positive_2       | A      | 16 bit                  | 0                   | 0.01                 | 0             | 655.3500        |
| Current_rectified_1      | A      | 16 bit                  | 32767               | 0.0001               | -3.2767       | 3.2768          |
| Power                    | W      | 32 bit                  | 0                   | 0.5                  | 0             | 1073741823.0000 |
| Energy_1                 | kWh    | 32 bit                  | 0                   | 0.1                  | 0             | 214748364.7000  |
| Energy_2                 | kWh    | 32 bit                  | 0                   | 1                    | 0             | 2147483647.0000 |
| Temperature_positive     | °C     | 16 bit                  | 0                   | 1                    | 0             | 65535.0000      |
| Temperature              | °C     | 16 bit                  | 32767               | 1                    | -32767        | 32768.0000      |
| Hours                    | h      | 16 bit                  | 0                   | 1                    | 0             | 23.0000         |
| Minutes                  | min    | 16 bit                  | 0                   | 1                    | 0             | 59.0000         |
| Year                     | a      | 16 bit                  | 0                   | 1                    | 0             | 99.0000         |
| Month                    | m      | 16 bit                  | 0                   | 1                    | 0             | 12.0000         |
| Day                      | d      | 16 bit                  | 0                   | 1                    | 0             | 31.0000         |
| Microseconds             | us     | 16 bit                  | 0                   | 1                    | 0             | 65535.0000      |
| Register                 | -      | 16 bit                  | 0                   | 1                    | 0             | 65535.0000      |
| Network address          | -      | 16 bit                  | 0                   | 1                    | 0             | 255.0000        |
| Without_unit_1           | -      | 32 bit                  | 0                   | 1                    | 0             | 2147483647.0000 |
| Without_unit_2           | -      | 16 bit                  | 0                   | 1                    | 0             | 65535.0000      |
| Percent                  | %      | 16 bit                  | 0                   | 1                    | 0             | 100.0000        |
| Solar radiation          | W/m2   | 16 bit                  | 0                   | 1                    | 0             | 1500.0000       |
| Solar energy             | kWh/m2 | 32 bit                  | 0                   | 0.1                  | 0             | 214748364.7000  |
| DATE                     | -      | YYYY,MM,DD              | -                   | -                    | -             | -               |
| TIME                     | -      | HH,MM,SS                | -                   | -                    | -             | -               |
| unformatted              | -      | 1...32 ASCII characters | -                   | -                    | -             | -               |

## 2.3 Type identification

The TYPE key provides a value for identifying the device type associated with a network node. The following values are currently defined:

| Device type           | TYP (dec) | Device type       | TYP (dec) | Device type     | TYP (dec) |
|-----------------------|-----------|-------------------|-----------|-----------------|-----------|
| SolarMax 1440TS-SV MT | 20812     | SolarMax 20HT2    | 20255     | SolarMax 3600SP | 11025     |
| SolarMax 1080TS-SV MT | 20809     | SolarMax 18MT3 A  | 20254     | SolarMax 3000SP | 11020     |
| SolarMax 720TS-SV MT  | 20806     | SolarMax 15MT3 A  | 20252     | SolarMax 2500SP | 11015     |
| SolarMax 360TS-SV MT  | 20803     | SolarMax 12MT2 A  | 20250     | SolarMax 2000SP | 11010     |
| SolarMax 1440TS-SV ST | 20712     | SolarMax 18MT3 SV | 20240     | SolarMax 1500SP | 11005     |
| SolarMax 1080TS-SV ST | 20709     | SolarMax 8MT2     | 20215     | SolarMax 1000SP | 11000     |
| SolarMax 720TS-SV ST  | 20706     | SolarMax 15MT2    | 20213     | MaxCount        | 10300     |
| SolarMax 360TS-SV ST  | 20703     | SolarMax 13MT2    | 20211     | MaxMeteo plus2T | 10210     |
| SolarMax 360TS-SV     | 20700     | SolarMax 10MT2    | 20210     | MaxMeteo        | 10200     |

|                       |       |                  |       |                  |      |
|-----------------------|-------|------------------|-------|------------------|------|
| SolarMax 4TP          | 20653 | SolarMax 15MT3   | 20208 | SolarMax 6000C   | 6010 |
| SolarMax 5TP2         | 20652 | SolarMax 13MT3   | 20206 | SolarMax 6000E   | 6000 |
| SolarMax 6TP2         | 20651 | SolarMax 10MT    | 20202 | SolarMax 4200C   | 4200 |
| SolarMax 7TP2         | 20650 | SolarMax 20S     | 20100 | SolarMax 4000C   | 4010 |
| SolarMax 5000P        | 20640 | SolarMax 35S     | 20110 | SolarMax 4000    | 4001 |
| SolarMax 4600P        | 20635 | SolarMax 6000S   | 20040 | SolarMax 4000E   | 4000 |
| SolarMax 4000P        | 20630 | SolarMax 4200S   | 20030 | SolarMax 3000C   | 3010 |
| SolarMax 3000P        | 20620 | SolarMax 3000S   | 20020 | SolarMax 3000E   | 3001 |
| SolarMax 2000P        | 20610 | SolarMax 2000S   | 20010 | SolarMax 3000    | 3000 |
| SolarMax 1320TS-SV MT | 20512 | SolarMax 60SHT-S | 11120 | SolarMax 2000C   | 2010 |
| SolarMax 990TS-SV MT  | 20509 | SolarMax 50SHT-S | 11115 | SolarMax 2000E   | 2001 |
| SolarMax 660TS-SV MT  | 20506 | SolarMax 60SHT   | 11110 | SolarMax 2000    | 2000 |
| SolarMax 330TS-SV MT  | 20503 | SolarMax 50SHT   | 11105 | SolarMax 330C-SV | 330  |
| SolarMax 1320TS-SV ST | 20412 | SolarMax 30SHT   | 11100 | SolarMax 300C    | 300  |
| SolarMax 990TS-SV ST  | 20409 | SolarMax 28SHT   | 11095 | SolarMax 125     | 126  |
| SolarMax 660TS-SV ST  | 20406 | SolarMax 25SHT   | 11090 | SolarMax 100     | 101  |
| SolarMax 330TS-SV ST  | 20403 | SolarMax 22SHT   | 11085 | SolarMax 100C    | 100  |
| SolarMax 300TS MT     | 20318 | SolarMax 20SHT   | 11080 | SolarMax 80C     | 80   |
| SolarMax 300TS ST     | 20316 | SolarMax 17SHT   | 11075 | SolarMax 60      | 61   |
| SolarMax 100TS        | 20314 | SolarMax 15SMT   | 11070 | SolarMax 50C     | 50   |
| SolarMax 80TS         | 20312 | SolarMax 13SMT   | 11065 | SolarMax 45      | 46   |
| SolarMax 50TS         | 20310 | SolarMax 10SMT   | 11060 | SolarMax 40      | 41   |
| SolarMax 32HT2        | 20266 | SolarMax 8SMT    | 11055 | SolarMax 35C     | 35   |
| SolarMax 32HT4        | 20262 | SolarMax 6SMT    | 11050 | SolarMax 30      | 31   |
| SolarMax 30HT4        | 20260 | SolarMax 6000SP  | 11045 | SolarMax 30C     | 30   |
| SolarMax 25HT4        | 20258 | SolarMax 5000SP  | 11040 | SolarMax 25C     | 25   |
| SolarMax 25HT2        | 20257 | SolarMax 4600SP  | 11035 | SolarMax 20      | 21   |
| SolarMax 20HT4        | 20256 | SolarMax 4000SP  | 11030 | SolarMax 20C     | 20   |

## 2.4 Available data

Depending on the device type, different data can be polled:

|                            |            |                         | SolarMax<br>Inverters | MaxMeteo | MaxCount |
|----------------------------|------------|-------------------------|-----------------------|----------|----------|
| <b>Value / meaning</b>     | <b>Key</b> | <b>Network variable</b> |                       |          |          |
| AC output                  | PAC        | Power                   | ✓                     |          |          |
| Operating hours            | KHR        | without_unit_1          | ✓                     |          |          |
| Date (new inverters)       | DATE       | Date                    | ✓                     |          |          |
| Date year (old inverters)  | DYR        | Year                    | ✓                     | ✓        | ✓        |
| Date month (old inverters) | DMT        | Month                   | ✓                     | ✓        | ✓        |
| Date day (old inverters)   | DDY        | Day                     | ✓                     | ✓        | ✓        |
| Energy year                | KYR        | Energy_2                | ✓                     |          |          |
| Energy month               | KMT        | Energy_2                | ✓                     |          |          |
| Energy day                 | KDY        | Energy_1                | ✓                     |          |          |
| Energy total               | KT0        | Energy_2                | ✓                     |          |          |
| Pulse counter 1 year       | I1Y        | Energy_1                |                       |          | ✓        |
| Pulse counter 1 power      | I1P        | Power                   |                       |          | ✓        |
| Pulse counter 1 scaling    | I1S        | without_unit_2          |                       |          | ✓        |
| Pulse counter 1 day        | I1D        | Energy_1                |                       |          | ✓        |
| Pulse counter 1 total      | I1T        | Energy_1                |                       |          | ✓        |
| Pulse counter 2 year       | I2Y        | Energy_1                |                       |          | ✓        |
| Pulse counter 2 power      | I2P        | Power                   |                       |          | ✓        |
| Pulse counter 2 scaling    | I2S        | without_unit_2          |                       |          | ✓        |
| Pulse counter 2 day        | I2D        | Energy_1                |                       |          | ✓        |
| Pulse counter 2 total      | I2T        | Energy_1                |                       |          | ✓        |
| Installed capacity         | PIN        | Power                   | ✓                     |          |          |
| Mains cycle duration       | TNP        | Microsecond             | ✓                     |          |          |
| Network address            | ADR        | Network address         | ✓                     | ✓        |          |
| Relative output            | PRL        | Percent                 | ✓                     |          |          |

|                             |      |                      |   |   |   |
|-----------------------------|------|----------------------|---|---|---|
| Software version            | SWV  | without_unit_2       | ✓ |   |   |
| Solar energy year           | RYR  | Solar energy         |   | ✓ |   |
| Solar energy day            | RDY  | Solar energy         |   | ✓ |   |
| Solar energy total          | RT0  | Solar energy         |   | ✓ |   |
| Solar radiation             | RAD  | Solar radiation      |   | ✓ |   |
| Voltage DC                  | UDC  | Voltage_2            | ✓ |   |   |
| Voltage phase 1             | UL1  | Voltage_2            | ✓ |   |   |
| Voltage phase 2             | UL2  | Voltage_2            |   |   |   |
| Voltage phase 3             | UL3  | Voltage_2            |   |   |   |
| Current DC                  | IDC  | Current_positive_2   | ✓ |   |   |
| Current phase 1             | IL1  | Current_positive_2   | ✓ |   |   |
| Current phase 2             | IL2  | Current_positive_2   |   |   |   |
| Current phase 3             | IL3  | Current_positive_2   |   |   |   |
| Temperature power unit 1    | TKK  | Temperature_positive | ✓ |   |   |
| Temperature power unit 2    | TK2  | Temperature_positive |   |   |   |
| Temperature power unit 3    | TK3  | Temperature_positive |   |   |   |
| Temperature solar cells     | TSZ  | Temperature          |   | ✓ |   |
| Type                        | TYP  | without_unit_2       | ✓ | ✓ | ✓ |
| Time (new Inverters)        | TIME | Time                 | ✓ |   |   |
| Time minute (old Inverters) | TMI  | Minute               | ✓ | ✓ | ✓ |
| Time hour (old Inverters)   | THR  | Hour                 | ✓ | ✓ | ✓ |

The exact meanings of the individual values can be found in the instruction manual for the device in question.

## 2.5 Settings and commands

Settings and commands start with port number 200 (0xC8), followed by the command key and an optional parameter.

Example for setting the hour:

```
{FB;2A;<Length>|C8:THR=10|<Crc>} sets the hour to 16.
```

Settings and commands are acknowledged with Ok or Ko, depending on whether or not they were executed. The Ok or Ko messages are case-sensitive.

```
{2A;FB;<Length>|C8:Ok|<Crc>} or {2A;FB;<Length>|C8:Ko|<Crc>}
```

For commands with a parameter, a response in the form of Ok or Ko only indicates whether or not the command was detected and processed. It does not indicate acceptance of the transferred parameter. The set value should therefore be queried again.

The commands are case-sensitive. The = symbol may not be preceded or followed by any spaces.

Commands without a parameter are sent without the = symbol.

## 2.6 Available settings and commands

Depending on the device type, different settings can be made:

|                           |      |                               | SM 2000E...<br>SM 6000C | SM 20C ...<br>SM 300C | MaxMeteo | MaxCount |
|---------------------------|------|-------------------------------|-------------------------|-----------------------|----------|----------|
| Value / meaning           | Key  | Parameter<br>Network variable |                         |                       |          |          |
| Set day                   | DDY= | Day                           | ✓                       | ✓                     | ✓        | ✓        |
| Set month                 | DMT= | Month                         | ✓                       | ✓                     | ✓        | ✓        |
| Set year                  | DYR= | Year                          | ✓                       | ✓                     | ✓        | ✓        |
| Set hour                  | THR= | Hour                          | ✓                       | ✓                     | ✓        | ✓        |
| Set minute                | TMI= | Minute                        | ✓                       | ✓                     | ✓        | ✓        |
| Clear all energy counters | CLR  | -                             | ✓                       | ✓                     |          |          |
| Set energy day            | KDY= | Energy_1                      | ✓                       | ✓                     |          |          |
| Energy month              | KMT= | Energy_2                      | ✓                       | ✓                     |          |          |
| Energy year               | KYR= | Energy_2                      | ✓                       | ✓                     |          |          |
| Set energy total          | KT0= | Energy_2                      | ✓                       | ✓                     |          |          |
| Set operating hours       | KHR= | without_unit_1                | ✓                       | ✓                     |          |          |
| Set installed capacity    | PIN= | Power                         | ✓                       | ✓                     |          |          |
| Pulse counter 1 day       | I1D= | Energy_1                      |                         |                       |          | ✓        |
| Pulse counter 1 scaling   | I1S= | without_unit_2                |                         |                       |          | ✓        |
| Pulse counter 1 total     | I1T= | Energy_1                      |                         |                       |          | ✓        |
| Pulse counter 1 year      | I1Y= | Energy_1                      |                         |                       |          | ✓        |
| Pulse counter 2 day       | I2D= | Energy_1                      |                         |                       |          | ✓        |
| Pulse counter 2 scaling   | I2S= | without_unit_2                |                         |                       |          | ✓        |
| Pulse counter 2 total     | I2T= | Energy_1                      |                         |                       |          | ✓        |
| Pulse counter 2 year      | I2Y= | Energy_1                      |                         |                       |          | ✓        |
| Solar energy day          | RDY= | Solar energy                  |                         |                       | ✓        |          |
| Solar energy total        | RT0= | Solar energy                  |                         |                       | ✓        |          |
| Solar energy year         | RYR= | Solar energy                  |                         |                       | ✓        |          |

### 3 Controlling a MaxDisplay-compatible large display

The MaxComm protocol also includes the definition for the "MaxDisplay" interface, enabling control of MaxDisplay-compatible displays. The display data are sent to the display from the network master. The following values can be transmitted:

| Value           | Key | Network variable |
|-----------------|-----|------------------|
| AC output       | PAC | Power            |
| Energy day      | KDY | Energy_1         |
| Energy total    | KT0 | Energy_2         |
| Energy year     | KYR | Energy_2         |
| Solar radiation | RAD | Solar radiation  |

A data packet for the display has the following structure:

```
{FA;FC;<Length>|64:PAC=1ABC;KDY=12A;KT0=13FB6;KYR=13FB6;RAD=1C2|<Crc>}
```

#### 3.1 Display logic requirements

- The address of the display node (*Dest-Add*) may be programmed permanently to FC.
- The source address (*Src-Add*) is always the same / can be ignored.
- *Port* is a fixed value (see sample string).
- The network is also used by other data packets. The display must be able to filter out the packets addressed to it.



- New data are sent periodically to the display. The periodicity is not fixed, but depends on the data traffic and the number of network devices. It is never less than 5 s.
- The display must not send back a response.
- If a data packet is defective (*CRC* or *Length* incorrect, incomplete/defective data record), the old data must be retained in the display.
- The data packet for the display always ends with an ETX.