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Salo, Finland 2012
PRODUCT CONFORMITY

SEATEL I-LINK 100 / 200 / 300
Hereby, SEATEL Oy declares that SEATEL I-LINK 100 / 200 / 300 I/O-converters are in compliance with the essential requirements and other relevant provisions of Directive 89/336/EEC. Therefore the equipment is labelled with the following CE-marking.

![CE Mark]

DECLARATION of CONFORMITY

In Accordance with
89/336/EEC Directive
of the European Council of 3rd May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility

Doc No: SEATEL-DC-EMC-089

Manufacturer: SEATEL Oy

Address: P.O.Box 142, Merinitrynkatu 17
24101 Salo
FINLAND

Product: SEATEL I-LINK 100 / 200 / 300 I/O Converters
SEATEL C-LINK Pulse Counter
SEATEL I-LINK I/O Converter and Pulse Counter

Application: External products for SATELLINE Radio Modems

We, the manufacturer of the above mentioned products, hereby declare that these products conform to the requirements of the European Council directive 89/336/EEC. This Declaration of Conformity is based on that the manufacturer has tested the Products according to the following standards:
EN 50140 (RF Immunity), EN 55022 / CISPR 22 (RF Emission), EN 61000-4-2 (ESD) and EN 61000-4-4 (EF/DBurst)

Salo on the 9th of August, 2010.

SEATEL OY

Pekka Aarnio
CEO

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E-mail: sales@seatel.com, www.seatel.com
WARRANTY AND SAFETY INSTRUCTIONS

Read these safety instructions carefully before using the product:

Warranty will be void, if the product is used in any way, which is in contradiction with the instructions given in this manual, or if the housing of the radio modem has been opened or tampered with.

The radio modem is to be used only on frequencies allocated by local authorities and without exceeding the given maximum allowed output power ratings. SATEL is not responsible, if any products manufactured by it are used in unlawful ways.

The devices mentioned in this manual are to be used only according to the instructions described in this manual. Faultless and safe operation of the devices can be guaranteed only if the transport, storage, operation and handling of the devices are appropriate. This also applies to the maintenance of the products.

To prevent damage both the radio modem and any terminal devices must always be switched OFF before connecting or disconnecting the serial connection cable. It should be ascertained that different devices used have the same ground potential. Before connecting any power cables the output voltage of the power supply should be checked.
### 1 GENERAL

#### 1.1 SATEL I-LINK 100 I/O- converter

The SATEL I-LINK 100 is a Point-to-Point or Point-to-Multipoint transparent I/O-converter. The device works together with SATELLINE modems. A digital or analogue I-LINK 100 input-point can be set through the modem to be output in the other end. Point-to-Multipoint transmission is possible adopting software suitable for the SATEL I-LINK 100.

<table>
<thead>
<tr>
<th>Output Connectors</th>
<th>Digital outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>O1...O4</td>
<td>+/- for analogue outputs</td>
</tr>
<tr>
<td>AO1, AO2</td>
<td>Analogue outputs</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Output indicators</th>
<th>Power ON/OFF indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON</td>
<td>Output indicators</td>
</tr>
<tr>
<td>O1-O4, AO1, AO2</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Setting switches</th>
<th>P-to-mp, Point-to-Multipoint</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROTOCOL</td>
<td>P-to-P, Point-to-Point</td>
</tr>
<tr>
<td>ADDRESS / CHANNEL</td>
<td>Multipoint address / Channel select *)</td>
</tr>
<tr>
<td>BAUD</td>
<td>Baud rate settings</td>
</tr>
<tr>
<td>3 DE</td>
<td>Alarm delay</td>
</tr>
<tr>
<td>4 SM</td>
<td>Safe mode</td>
</tr>
<tr>
<td>5 HS</td>
<td>Handshaking</td>
</tr>
<tr>
<td>TIME</td>
<td>Transmission interval of analogue inputs</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input Connectors</th>
<th>Indicator for failed transmission</th>
</tr>
</thead>
<tbody>
<tr>
<td>I1...I4, AI1, AI2</td>
<td>Input indicators</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input Connectors</th>
<th>Supply Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>9-30VDC/ +</td>
<td>Alarm output</td>
</tr>
<tr>
<td>AL OUT</td>
<td>Common +/- for digital inputs and extension units</td>
</tr>
<tr>
<td></td>
<td>Digital inputs</td>
</tr>
<tr>
<td></td>
<td>Analogue inputs</td>
</tr>
<tr>
<td></td>
<td>-/+ for analogue inputs</td>
</tr>
<tr>
<td></td>
<td>Connector for radio modem</td>
</tr>
<tr>
<td></td>
<td>Connector for extension units</td>
</tr>
</tbody>
</table>

*) Valid only together with SATELLINE-1870 and 1870E radio modems.
# 2 SPECIFICATIONS

<table>
<thead>
<tr>
<th>FEATURE</th>
<th>min-max</th>
<th>typical</th>
<th>note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>+9…+30 Vdc</td>
<td>24 Vdc, typical</td>
<td></td>
</tr>
<tr>
<td>Power consumption</td>
<td>0.3 ... 1.0 W</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serial Interface</td>
<td>RS-232 ± 15 Vdc</td>
<td>± 6 Vdc</td>
<td>active RS232</td>
</tr>
<tr>
<td>Extension Interface</td>
<td>-0.3…+6 Vdc</td>
<td>0.5…5 Vdc</td>
<td>active TTL</td>
</tr>
<tr>
<td>Response time</td>
<td>&lt; 250 ms</td>
<td>&lt; 300 ms</td>
<td>@ 9600 bps</td>
</tr>
<tr>
<td>Operational temperature</td>
<td>-25…+55 °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transfer rates</td>
<td>2400 – 19200 bps</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stability</td>
<td>± 1 %</td>
<td></td>
<td>@ for whole temp. range</td>
</tr>
</tbody>
</table>

**ANALOGUE SIGNALS**

- Inputs, 2 pcs: 0 – 25 mA 4 – 20 mA resistive 165 Ω
- Outputs, 2 pcs: 0 – 25 mA 4 – 20 mA active
- Sample interval: cont- 120min selectable
- Resolution: 12 bits
- Accuracy: <0.4 %

**DIGITAL SIGNALS**

- Inputs, 4 pcs: 0 – 35 Vdc 0 – 30 Vdc resistive 4-5 kΩ
- Outputs, 4 pcs: 0 – 250 Vac / 2 A relay contacts

**INDICATORS**

- Indicators: Power ON/OFF, digital/analogue IN/OUT, Alarm

**OTHER OUTPUTS**

- Alarm Output: 0 – 35 Vdc / 30 mA 24 Vdc / 20 mA active + 30 mA

**GENERAL**

- Casing: Stainless steel
- Fail-state: In the fail-state all I/O-points remain unchanged
- Connectors: D-15 for SATELLINE radio modem, D-15 for the extension module
- Size L x W x H: 123 x 85 x 30 mm
- Weight: 120 g
- Mounting: Wall plate or DIN-rail
- IP: IP-20
- Modem compatibility: SATELLINE-2ASxE, 3AS-serie, 1870, 1870E and 1915

Connection between I-LINK 100 and SATELLINE radio modem

<table>
<thead>
<tr>
<th>Direction</th>
<th>Signal</th>
<th>I-LINK100, D-15</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+VB, DTR</td>
<td>1, 14, 15</td>
</tr>
<tr>
<td></td>
<td>GND, SGND</td>
<td>7, 8</td>
</tr>
<tr>
<td></td>
<td>RD</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>TD</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>RTS</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>CTS</td>
<td>6</td>
</tr>
</tbody>
</table>
3 FUNCTIONS

3.1 Operational Voltage, 9 – 30 Vdc
- The supply voltage is connected to the connector 9-30 VDC (-) and (+).
- + OUT connected to VDC through an internal fuse. The supply voltage for the extension units must be taken from this output. Can also be used for analogue input sensors.

3.2 Alarm output, AL OUT
- The AL OUT is activated if three (3) transmission fails occur in turn. When activated the output state goes to +VDC. When the transmitting I-LINK 100 sends information to another I-LINK 100 it requires a confirmation. In case there is a fail in transmission and the I-LINK does not receive the confirmation, the transmission will be resend maximum three (3) times or until a confirmation is received.

3.3 +OUT
- A voltage output for the extension units. Connected to +VDC through an internal fuse.

3.4 Digital Inputs (I1…I4) and Outputs (O1…O4)
- Inputs,
  - 4 pcs. Activated with + voltage.
  - An input must maintain the active state >50 ms for proper detection.
- Outputs,
  - 4 pcs. Open relay contacts. Can be connected to any 0 - 250 Vac / 2A load.
  - All outputs are set active for a period of ~240 ms, starting ~6 ms after switching the supply voltage to the unit.

3.5 Analogue inputs (AI1 –, AI1+, AI2–, AI2+) and outputs (AO1–, AO1+, AO2–, AO2+)
- Inputs,
  - 2 pcs. Normal range is 4 - 20 mA. Whole range is 0 – 25 mA showing that the limits have been exceeded. The input load is resistive 165 Ω.
- Outputs,
  - 2 pcs. Normal range is 4 – 20 mA. Whole range is 2-25mA.
- Sample Interval
  - Sample interval sets the time how often analogue information is sent. The sample interval can be selected using the 3 TIME-switches according to the time table i.e. “000” sends an analogue level sample in each 120 minutes intervals, “011” each 10 minutes etc. “111” will cause a continuous transmission. Due to modem’s functionality this is about in each (1) second.

3.6 Indicators
- ON
  - Power ON/ OFF. Illuminated when +VCD connected.
- O1…O4, AO1, AO2
o Showing the status of the output. Illuminated when there is information on the output. Flashing when range has been exceeded. OFF, when low state or nothing on the input.

o ALARM
  o Illuminated, if a fail in transmission has occurred. When the transmitting I-LINK 100 sends information to another I-LINK 100 it requires a confirmation. In case there is a fail in transmission and the I-LINK does not receive the confirmation, the transmission will be resent maximum three (3) times or until a confirmation is received.

o 11…14, AI1, AI2
  o Showing the status of the input, illuminated steadily when the input is in the normal 4 – 20 mA range. Flashing when range has been exceeded. OFF, when low state or nothing on the input.

### 3.7 Switches

- **PRTCL**, Protocol-switch
  - P-to-MP @ Point-to-Multipoint (Master-Slave) -operation.
  - P-to-P @ Point-to-Point -operation

- **ADDRESS / CHANNEL**
  - Used at Point-to-Multipoint- operation to select the individual I-LINK 100
  - Maximum number of addresses is 127.

- **ADDRESS / CHANNEL**
  - The channel selector is used together with M2M-package and SATELLINE-1870 or 1870E radio modems. More information about this in the user guide of M2M-package. NOTE! Check that the address switches are not used (ON) in Point-to-Point mode with other than SATELLINE-1870 or 1870E radio modems.

- **BAUD**
  - The baud rate can be selected as follows: 00=2.4 kb/s, 10=4.8 kb/s, 01=9.6 kb/s, 11=19.2 kb/s

- **3 DE** Delayed alarm setting

- **4 SM** Safe Mode setting
  - Immediate / Delayed Alarm
    - In case of a failure in the transmission, the alarm response can be selected from immediate alarm to 10 minutes delayed
  - Unchanged state / Safe Mode state
    - In case of a failure in transmission, the outputs can be set to remain their status or change to “Safe Mode” which will switch all outputs to OFF-position. Safe Mode timing follows the setting of switch 3 DE, so it can be immediate or delayed.

The functions set by the dip-switches 3 and 4 are as follows:

<table>
<thead>
<tr>
<th>3 DE</th>
<th>4 SM</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0 = Immediate Alarm / No Safe Mode</td>
</tr>
<tr>
<td>0</td>
<td>1 = Immediate Alarm / Immediate Safe Mode</td>
</tr>
<tr>
<td>1</td>
<td>0 = Alarm delayed by 10 minutes / No Safe Mode</td>
</tr>
<tr>
<td>1</td>
<td>1 = Alarm delayed by 10 minutes / Safe Mode delayed by 10 minutes</td>
</tr>
</tbody>
</table>
- **5 HS** For setting CTS-control (clear to send) On or OFF
  1 = CTS OFF, 0 = CTS ON.

- **TIME**
  - Defines how often the analogue input message is transmitted. The intervals are as follows:
    - 000 = 120 min
    - 001 = 60 min
    - 010 = 30 min
    - 011 = 10 min
    - 100 = 5 min
    - 101 = 1 min
    - 110 = 10 sec
    - 111 = continuous
4 OPERATION

Operation mode is selected by using the PRTCL-switch. The operations are Point-to-Point or Point-to-Multipoint. In Point-to-Point operation the system has one pair of units, whereas the inputs at one end will became outputs on the other end. In Multipoint mode one master can command one or more (max 127) slaves.

4.1 Point-to-Point

Point-to-point operation is between two units. The inputs of one I-LINK 100 will be transferred to the outputs of other I-LINK 100.

4.1.1 Updating digital messages

Digital information (relay, switch etc.) will be sent to the other unit always, when there is a state change at the input.

4.1.2 Updating analogue messages

Analogue information will be sent to the other unit according to the TIME-setting or as well as digital information state changes.

4.1.3 Beginning with Point-to-Point operation

- Connect SATELLINE radio modem to I-LINK 100 directly to the RADIO MODEM - connector or using the interface cable.
- The “PRTCL”- switch must be “0” in the P-to-P-position.
- Before connecting the device to a power supply, connect first all inputs and outputs that are to be used.
- Select the SATEL I-LINK 100 BAUD-rate. 00=2.4, 10=4.8, 01=9.6, 11=19.2
- Check that the radio modem baud rate is same as for the I-LINK and the other parameters are “9600-N-8-1” (9600 bps is a default setting, but can be changed to be any of the BAUD-rates given above).
- Set the analogue message transmission time interval using TIME-switches as described above, if that feature is needed.
- When both units have these basic settings (TIME can be different) the supply voltage can be connected.
- NOTE! Check that the address switches are not used (ON) in Point-to-Point mode with other than SATELLINE-1870 or 1870E radio modems.

4.2 Point-to-Multipoint

In this mode one Master can drive one or more slaves (max 127 pcs).

4.2.1 Updates

The updates are controlled by the Master, which sends messages to the slaves or asks status information from them. As the master is the controlling unit the TIME settings of the I-LINK 100 is not valid.

There are two options on how to use the Point-to-Multipoint with the I-LINK 100.
1. You can have your own system and program and integrate I-LINK 100 into it; the commands are described below.
2. You can have an easy-to-use SATEL I-LINK PC-software.

### 4.3 Starting the Multipoint operation

- Connect one SATELLINE radio modem to the PC COM-Port. This one is the Master unit.
- Connect the I-LINK 100 Slave-units to the SATELLINE radio modems directly to I-LINK 100 Radio Modem connector or using a interface cable
- The “PRTCL”- switch must be “1 “, in the P-to-MS-position.
- Before connecting the device to a power supply, connect first all inputs and outputs that are to be used.
- Select the SATEL I-LINK 100 BAUD-rate. 00=2.4, 10=4.8, 01=9.6, 11=19.2
- Check that the radio modem baud rate is same as for I-LINK and that other parameters are “9600-N-8-1” (9600 bps is a default setting, but can be changed to be any of the BAUD-rates given above).
- Set the individual addresses to all slaves. (As this is a Master–Slave operation, the Slaves have to be addressed). All slaves must have different address.

### 4.4 Multipoint messages

#### 4.4.1 General information

The functions of an I-LINK 100 converter and its extension units can be controlled or status information requested by the Multipoint messages. The data communication between SATELLINK PC (Pro) software and I-LINK 100 is based on these messages. The messages can be implemented to customer specific application software as well.

All multipoint messages are ASCII character strings. Their general structure is as seen below.

**General message structure**

```plaintext
<STX>  DATA  CRC  <ETX>
```

Each message begins with a character `<STX>` (‘start of text’, 02 hex) and ends with a character `<ETX>` (‘end of text’, 03 hex).

The messages (except ACK and NACK) include also a CRC checksum field for error check purposes. The CRC checksum must be inserted to messages by the user equipment. CRC-value is calculated from the DATA field only.

The DATA field contains addresses, extension definition, length and the actual message.

#### List of different message types

<table>
<thead>
<tr>
<th>Message Type</th>
<th>Function</th>
<th>Description</th>
<th>Sub clause</th>
</tr>
</thead>
<tbody>
<tr>
<td>SET</td>
<td>Set command or</td>
<td>Sets the digital or analogue outputs of an I-LINK 100 or its extension unit.</td>
<td>4.4.2</td>
</tr>
<tr>
<td></td>
<td>Status reply</td>
<td>Or is a reply to a request (GET) of output status.</td>
<td></td>
</tr>
<tr>
<td>GET</td>
<td>Status request</td>
<td>Requests for digital or analogue input status of an I-LINK 100 or its extension unit.</td>
<td>4.4.3</td>
</tr>
<tr>
<td>ACK</td>
<td>Acknowledgement</td>
<td>I-LINK 100 replies with an ACK-message if it has received a command properly.</td>
<td>4.4.4</td>
</tr>
<tr>
<td>NACK</td>
<td>Message not</td>
<td>If a command has not been properly received,</td>
<td>4.4.5</td>
</tr>
</tbody>
</table>
4.4.2 SET-message

With SET-message the MASTER sets the states for the slave. After a sent message master waits for the acknowledgement. If everything was ok, the slave answers by sending an ACK-message. If the message was got but not understood (i.e. fail in CRC), the slave sends a NACK-message. The slave sends SET messages only by request. The master can send SET-messages any time.

The structure of a SET-message

<table>
<thead>
<tr>
<th>Field value (ASCII)</th>
<th>&lt;STX&gt;</th>
<th>4C</th>
<th>12</th>
<th>FFF</th>
<th>0A</th>
<th>SET3000000</th>
<th>49A6</th>
<th>&lt;ETX&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field size (bytes)</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>10</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Bit value (hex)</td>
<td>02</td>
<td>3443</td>
<td>3132</td>
<td>464646</td>
<td>3041</td>
<td>see below</td>
<td>34394136</td>
<td>03</td>
</tr>
<tr>
<td>Description</td>
<td>Start char.</td>
<td>Receiver address</td>
<td>Sender address</td>
<td>Extension definition</td>
<td>Length</td>
<td>MESSAGE</td>
<td>CRC-checksum</td>
<td>End char.</td>
</tr>
</tbody>
</table>

The MESSAGE includes all commands to the unit. In the example it is SET3000000. The structure is as follows:

<table>
<thead>
<tr>
<th>Field value (ASCII)</th>
<th>SET</th>
<th>3</th>
<th>000</th>
<th>000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field size (bytes)</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Bit value (hex)</td>
<td>534554</td>
<td>33</td>
<td>303030</td>
<td>303030</td>
</tr>
<tr>
<td>Description</td>
<td>Command</td>
<td>Setting of digital output ports</td>
<td>Setting of analogue port1</td>
<td>Setting of analogue port2</td>
</tr>
</tbody>
</table>

Extension module definitions

<table>
<thead>
<tr>
<th>Character in Extension definition field</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>No extension unit in position</td>
</tr>
<tr>
<td>1</td>
<td>I-LINK 200 installed</td>
</tr>
<tr>
<td>2</td>
<td>I-LINK 300 installed</td>
</tr>
</tbody>
</table>

Example: 3 extension modules installed, I-LINK 200 + I-LINK 300 + I-LINK 200 → Extension field value = 121.
Message examples when the extension modules are used.

Example A: 1 Extension module, I-LINK 200 (4 digital + 2 analogue I/O)

<table>
<thead>
<tr>
<th>&lt;STX&gt;</th>
<th>01</th>
<th>02</th>
<th>1FF</th>
<th>11</th>
<th>SET2000000200000000</th>
<th>3904</th>
<th>&lt;ETX&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start</td>
<td>Receiver address</td>
<td>Sender address</td>
<td>Extension definition</td>
<td>Length</td>
<td>MESSAGE</td>
<td>CRC-checksum</td>
<td>End char.</td>
</tr>
</tbody>
</table>

Example B: 2 Extension modules, I-LINK 200 (4 digit. + 2 anal.)+ I-LINK 300 (6 digital)

<table>
<thead>
<tr>
<th>&lt;STX&gt;</th>
<th>01</th>
<th>02</th>
<th>12F</th>
<th>13</th>
<th>SET20001008000800F3</th>
<th>FB0B</th>
<th>&lt;ETX&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start</td>
<td>Receiver address</td>
<td>Sender address</td>
<td>Extension definition</td>
<td>Length</td>
<td>MESSAGE</td>
<td>CRC-checksum</td>
<td>End char.</td>
</tr>
</tbody>
</table>

Example C: 3 Extension modules, I-LINK 200 + I-LINK 300 + I-LINK 200

<table>
<thead>
<tr>
<th>&lt;STX&gt;</th>
<th>01</th>
<th>02</th>
<th>121</th>
<th>13</th>
<th>SET20000002000000F320000000</th>
<th>5318</th>
<th>&lt;ETX&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start</td>
<td>Receiver address</td>
<td>Sender address</td>
<td>Extension definition</td>
<td>Length</td>
<td>MESSAGE</td>
<td>CRC-checksum</td>
<td>End char.</td>
</tr>
</tbody>
</table>

Table for setting the digital outputs ON. All Ports OFF = 0

<table>
<thead>
<tr>
<th>Ports set</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set Value (ASCII)</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Table for setting the analogue values (increases 0.006059082 mA / step)

<table>
<thead>
<tr>
<th>Set value (ASCII)</th>
<th>000</th>
<th>001</th>
<th>002</th>
<th>003</th>
<th>004</th>
<th>.......</th>
<th>FFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value (mA)</td>
<td>000</td>
<td>006</td>
<td>012</td>
<td>018</td>
<td>024</td>
<td>.......</td>
<td>24,818</td>
</tr>
</tbody>
</table>

4.4.3 GET-message

With GET-message the Master can ask the status from the slave. GET-message is always answered by ACK-message followed by SET-message. If the slave receives the message, but it was not understood (i.e. fail in CRC), the slave answers with a NACK-message.

The structure of a GET-message is as follows:

<table>
<thead>
<tr>
<th>&lt;STX&gt;</th>
<th>4C</th>
<th>12</th>
<th>03</th>
<th>GET</th>
<th>F475</th>
<th>&lt;ETX&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start character</td>
<td>Receiver address</td>
<td>Sender address</td>
<td>Length</td>
<td>Message</td>
<td>CRC-checksum</td>
<td>End character</td>
</tr>
</tbody>
</table>

4.4.4 ACK-message

The equipment that has received a GET or SET request, will answer with an ACK-message.
The structure of an ACK-message is as follows:

<table>
<thead>
<tr>
<th>Field</th>
<th>Size (no of char.)</th>
<th>Description / Value options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safe mode</td>
<td>1</td>
<td>Describes what must be done, if the time count is exceeded.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“0” = no action.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“1” = Sets the Alarm high.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“2” = Sets all Output low and Alarm high.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“3” = Sets all Output high and Alarm high.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“4” = Sets the Outputs to pre-defined stages and Alarm high.</td>
</tr>
<tr>
<td>Time setting</td>
<td>4</td>
<td>Defines the polling time interval from the master station. If value is 0 it will not be counted. The resolution time value is described in minutes.</td>
</tr>
<tr>
<td>Port settings</td>
<td>7…28</td>
<td>See chapter 4.4.2 for port setting options of I-LINK 100, 200 and 300</td>
</tr>
</tbody>
</table>

NOTE! CFS command saves always port states, regardless of the Time and Safe Mode settings.

4.4.7 CFG-message (get)

CFG command works in a similar way as GET command.
The structure of a CFS message:

<table>
<thead>
<tr>
<th>&lt;STX&gt;</th>
<th>4C</th>
<th>12</th>
<th>03</th>
<th>CFG</th>
<th>&quot;2&quot;</th>
<th>&lt;ETX&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start char.</td>
<td>Receiver address</td>
<td>Sender address</td>
<td>Length</td>
<td>Command name</td>
<td>CRC-checksum</td>
<td>End char.</td>
</tr>
</tbody>
</table>

*2 = value depends on the data field contents.

The CFG-question is acknowledged with ACK, followed by CFS, which describes the current settings.

NOTE! When the slave gets any message from the master after the alarm, it will automatically set all the output ports to the previous state.

4.4.8 VER-message

This message retrieves the SW-version of the I-LINK 100 VER. SW-question.

The structure of a VER request message:

<table>
<thead>
<tr>
<th>&lt;STX&gt;</th>
<th>01</th>
<th>00</th>
<th>03</th>
<th>VER</th>
<th>657A</th>
<th>&lt;ETX&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start char.</td>
<td>Receiver address</td>
<td>Sender address</td>
<td>Length</td>
<td>Message</td>
<td>CRC-checksum</td>
<td>End char.</td>
</tr>
</tbody>
</table>

The structure of a VER response message:

<table>
<thead>
<tr>
<th>&lt;STX&gt;</th>
<th>4C</th>
<th>12</th>
<th>FFF</th>
<th>03</th>
<th>VRS</th>
<th>v1.0A*1</th>
<th>A0DB</th>
<th>&lt;ETX&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start char.</td>
<td>Receiver address</td>
<td>Sender address</td>
<td>Extension definition</td>
<td>Length</td>
<td>Message</td>
<td>SW Version</td>
<td>CRC-checksum</td>
<td>End char.</td>
</tr>
</tbody>
</table>

*1 = please note that the “v” is a lower case letter, not a capital one.

4.5 CRC-checksum function

The checksum to be used is a 16 bit CRC (Cyclic Redundancy Check) checksum. (CRC-value is calculated from the DATA-message only (incl. addresses, extension definition, length and message).

The CRC used in the message protocol of I-LINK 100 is calculated in a similar way to the widely used CRC-CCITT but using slightly different values of parameters.

The parameters used in the calculation of CRC checksums are:
- Polynomial - Defines the polynomial for the calculation. I-LINK 100 uses the polynomial \( x^{16} + x^{12} + x^5 + 1 \) (i.e. 0x1021 for the algorithm of SATEL I-LINK 100)
- Initial Value = the value to be initially loaded in the crc register before the calculation.
- Reverse Databits = Reverse the bit order (lsb<->msb) of the data bytes before the calculation.
- Reverse result before XOR = is the bit order of the result of the calculation to be reversed or not before the final XOR operation.
- XOR = the final step - the value to be XORed with the result of the calculation.
The CRC used in the message format of SATEL I-LINK 100 is calculated using the parameters below:
- Polynomial = 0x1021 (CCITT)
- Initial Value = 0xFFFF
- XOR = FFFF
- Reverse Databits = Yes
- Reverse result before XOR = Yes

To compare, CRC-CCITT is calculated using the following parameters:
- Polynomial = 0x1021 (CCITT)
- Initial Value = 0xFFFF
- XOR = 0
- Reverse Databits = No
- Reverse result before XOR = No

Note: The contents of the Checksum field of the actual message can be derived by converting the 16 bit binary CRC checksum to four hex-ascii characters.
An example: if the checksum is 0001111100000010 (binary), the four ASCII characters of SSSS will be ‘1’, ‘F’, ‘0’ and ‘2’ consequently.

The source code listing written in C language below can be applied to calculate the binary value of CRC:

```c
unsigned short CRC_16 (unsigned char length, unsigned char *data) {
    unsigned short crc_table[16] = {
        0x0000, 0x1081, 0x2102, 0x3183, 0x4204, 0x5285, 0x6306, 0x7387,
        0x8408, 0x9489, 0xA50A, 0xB58B, 0xC60C, 0xD68D, 0xE70E, 0xF78F
    };
    unsigned short crc = 0xFFFF;
    unsigned char tmp, index, i;
    for (i = 0; i < length; i++) {
        tmp = data[i];
        index = ((crc ^ tmp) & 0x000F);
        crc = ((crc >> 4) & 0x0FFF) ^ crc_table[index];
        tmp >>= 4;
        index = ((crc ^ tmp) & 0x000F);
        crc = ((crc >> 4) & 0x0FFF) ^ crc_table[index];
    }
    return (~crc);
}
```
5 FACTORY SETTINGS

The I-LINK 100 I/O-converter is shipped with the following default settings (unless specifically ordered with settings other than those listed below):

<table>
<thead>
<tr>
<th>FIXED SETTINGS DEFINED AT THE TIME OF ORDER</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRTCL, protocol-switch</td>
</tr>
<tr>
<td>ADDRESS</td>
</tr>
<tr>
<td>BAUD</td>
</tr>
<tr>
<td>3 DE, Alarm delay</td>
</tr>
<tr>
<td>4 SF, Safe mode</td>
</tr>
<tr>
<td>5 HS Handshaking</td>
</tr>
<tr>
<td>TIME, Analogue transmission interval</td>
</tr>
</tbody>
</table>
6 CONNECTION EXAMPLES

Point-to-Multipoint with one master and two slaves

Transparent Point-to-Point application
7 ACCESSORIES

INTERFACE CABLES FOR CONNECTING OF I-LINK 100 AND SATELLINE RADIO MODEMS

<table>
<thead>
<tr>
<th>Point-to-Point</th>
<th>CRS-TSU</th>
<th>I-LINK 100</th>
<th>SATELLINE-2ASxE, 3AS-serie</th>
</tr>
</thead>
<tbody>
<tr>
<td>Point-to-Point</td>
<td>CRS-18IF</td>
<td>I-LINK 100</td>
<td>SATELLINE-1870, 1870E</td>
</tr>
<tr>
<td>Point-to-Multipoint</td>
<td>CRS-2F</td>
<td>PC</td>
<td>SATELLINE-2ASxE, 3AS-serie</td>
</tr>
<tr>
<td>Point-to-Multipoint</td>
<td>CRS-18F</td>
<td>PC</td>
<td>SATELLINE-1870, 1870E</td>
</tr>
</tbody>
</table>

SATEL I-LINK PC and SATELLINK PC Pro

Complete program that makes it possible to operate a Multipoint system with a PC. SATEL I-LINK PC is a basic version of the program. SATELLINK PC Pro is more detailed professional version.

Layout of the SATEL I-LINK PC Multipoint-program
8 EXTENSION MODULES

General
1...3 extension modules can be connected to SATEL I-LINK 100. The system functions both on Point-to-Point and Multipoint protocols. At Point-to-Point protocol the respective extension modules operate as pairs according to their address setting. The extension modules must always be connected to I-LINK 100 control unit, they do not operate alone.

I-LINK 200, 4 digital and 2 analogue inputs and outputs
I-LINK 300, 6 digital inputs and outputs

Assembly
The modules are joined together by connecting the EXTENSION and To EXTENSION connectors as in the picture. The extension modules can be joined in any order. The number of extension modules is 1...3 pcs (I-LINK 100 + 1...3 extension modules).

I-LINK 100 Main module
4 digital
2 analogue I/O-ports

I-LINK 200 Extension
4 digital
2 analogue I/O-ports

I-LINK 300 Extension
6 digital I/O-ports

Connections
The I/O-ports of the extension modules are connected same way as the main unit’s I/O-ports. The supply voltage is not linked through the modules, so it must be connected using the green screw contacts. The supply voltage must be connected directly to the I-LINK 100. The I-LINK 100 is equipped with and internal fuse (self recovery type), therefore the extension must get the supply voltage from the pin +OUT. If there are many Extension modules the linking can be done what is the most practical for the wire work (see the picture).

Settings
Extension modules that are working as pairs in Point-to-Point operation must be same type and have same address. The address is set by the “Module Address”- switches. The alternatives are: 00=Module not in operation, 01, 10 and 11. Location is shown in the picture as “Address”.

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