

Interference Corrosion Logger, **ICL-02i** Wireless Modem, **M-Link**

& M-Config Software

User Manual

100086-05

© MetriCorr ApS

Produktionsvej 2

DK-2600 Glostrup

Denmark

Phone +45 72 17 74 10

www.metricorr.dk

info@metricorr.dk

WARNING – SAFETY PRECAUTIONS

This product is electrically connected to buried pipelines. Hazardous voltage levels may occur on the pipelines and will in such cases also be present on the instrument pipe connections and the electrical parts of the probe. Do not touch these parts when the instrument is connected to the pipeline.

Disposal

The ICL-02 is electronic equipment and must not be disposed.

The instrument shall be returned to the manufacturer.



Information within this document is subject to change without notice

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What's New

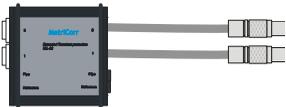
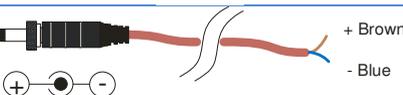
ICL-02i is an improved version of the ICL-02.

You will find these improvements in the **ICL-02i**

- Simultaneously measurement of voltage and current - probe by probe
 - Improved determination of spread resistance – R_s
 - Better determination of Edc-IR-free
 - Probe connected to pipe during measurement
- Resistance range 0 – 80 m Ω
(can also be ordered to 0 – 640m Ω)
 - Resolution improved by 2.5 times
- Calibration of ER Resistance measurement
 - Calibration to traceable standard resistor
- Power management
 - Halting measurements, when power is weak
 - Prevents faults and drain if power is low i.e. during cold nights
 - Detecting supply voltage and source resistance
 - Power Weak indication in measurement file
- Improved DC power input plug.
 - NOTE: Not compatible with previous batteries and AC/DC adaptors
- Improved AC current measurement
 - Compensation for current shunt resistor – relevant for very low spread resistance
- Optional **ICL-02i-CT** with analog ER outputs

Products Covered by this Manual

ICL-02i and Related Parts

	Name	No.
	The ICL-02 <i>i</i> - Interference Corrosion Logger	100082
	ETP, Extended Transient Protection	100215
	Serial interface cable	100030
	Converter RS232 to USB	100117
	Battery Cable	100068
	Calibration Certificate	100415
	ICL-02i Installation guidelines	100489
	Test Leads, Sub D to 4mm safety plugs ¹	100440

¹ For ICL-02i CT only

M-Link and Related Parts

	Name	No.
	M-Link, Wireless modem IP65	100235
	PC - M-Link, USB cable	100239
	External DC power - M-Link cable for external DC supply	100238
	- AC/DC Adaptor Power Supply for use with mains supply	100264
	SIM Card	
	GSM Antenna, QUAD Band	100191

Parts for both ICL-02i and M-Link

	Name	No.
	M-Config Software	100182
	M-Link to ICL-02i cable	100326

Accessories that come with the package depend on the region and application.

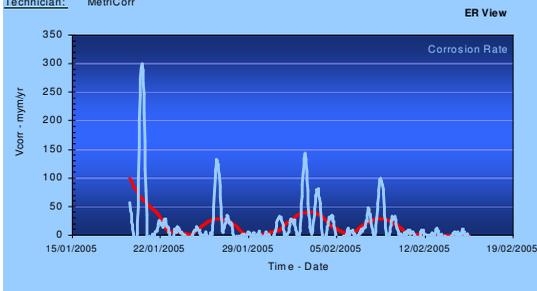
Note:

The M-Config PC software V2.11 or newer must be installed on your PC to control the new **ICL-02i** and the M-Link Wireless Modem. M-Config also control the previous ICL-02.

Working with ER coupons and the datalogger



Date: Jan. 19th - Feb. 15th 2004
Description: Coupon B test post km 45.78
Technician: MetriCorr



Overview

Initial considerations before working with the ICL

Read the brief introduction to ER technology, page 11 and 12.

Functionality Overview – page 13.

Installation of the M-Config PC Software– page 15

Configuring probe / coupon – page 21

Working with ICL-02i and M-Config PC software- page 18

Working with ER coupons and the ICL on a routine basis

Use the ICL M-Config software to prepare your ER coupon certificates in your computer and to configure your ICL logging setup.

Install the coupons in the soil.

Arrange the coupon connections and your ICL and ETP in a test post with electrical connection to the pipe. Connect the coupons and the pipe terminal to the ICL and ETP through which the coupons will have pipe connection.

Start your ICL and collect data either by direct PC interface or remote through the M-Link wireless modem.

Through the M-Report software tool you can organize measurements and presentations or alternatively manage them in Excel

Use ER coupons/soil corrosion probes *as an ON-LINE weight loss measurement*

- * Cost Effective - easy to use
- * Adds time stamped corrosion rate data to electrical fingerprints



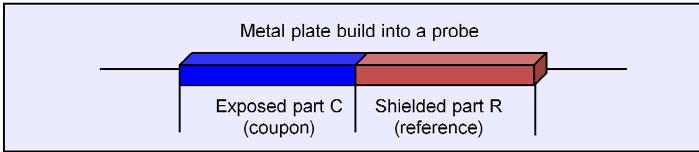
An ER (Electrical Resistance) coupon/soil corrosion probe is used for measurements of corrosion rate at the position where the coupon is placed. For verification of cathodic protection efficiency of buried structures – for instance pipelines - the coupon/probe is electrically connected to the structure and placed in the soil adjacent hereto. The coupon/probe acts as an artificial coating defect, and the corrosion rate in this is used to assess the risk of corrosion of the structure when exposed through a coating defect to the chemical and electrical environment in which the coupon/probe is placed.

The use of ER coupons/soil corrosion probes is particularly useful for assessment of the risk of corrosion due to AC or DC interference (AC-influenced corrosion – corrosion due to DC stray currents). Refer to relevant standards.

ER probes are well integrated and commonly accepted tools for monitoring internal corrosion in process plants. The ER concept has been employed as an alternative to corrosion measurements by weight loss determination on exposed coupons. The drawbacks of weight loss measurements is primarily that the coupon has to be withdrawn from the environment, brought to the laboratory for cleaning and weighing procedures which are costly and time-consuming. The ER concept is ON-LINE and does not require excavation of the coupon for corrosion evaluation. Therefore, the ER concept is cost effective and provides a measure of the logical monitoring parameter - CORROSION – on top of the traditional electrical measurements made on coupons for CP verification.

Brief Technical Description of ER technique

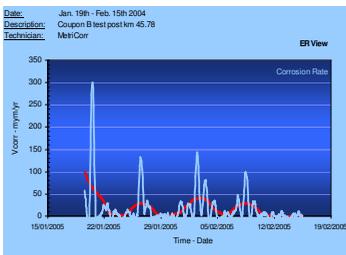
The MetriCorr technology for verification of CP effectiveness is based on a specialized ER-concept. We form the coupon as a part of an ER probe consisting of a metal plate divided into two parts. One part being exposed to the soil (coupon part), the other part (reference part) being physically shielded to effectively avoid corrosion.



The actual thickness of the coupon can be verified by measuring the electrical resistance throughout time of the coupon since the electrical resistance is a function of the plate dimensions. Comparing with simultaneous measurements of the electrical resistance of the reference will provide temperature compensated thickness values through:

$$\text{Thickness} = \text{initial thickness} \cdot \frac{R}{C} \cdot \frac{\text{initial } C}{\text{initial } R}$$

where R and C are resistance values of coupon and reference part of the plate.



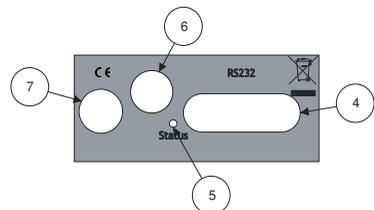
The slope of a plot of the thickness versus time will provide a measure of corrosion rate. Using the ICL-02i datalogging unit, you will acquire data that can be processed to give time stamped corrosion rate and electrical properties for diagnostic purposes.

Functionality Overview

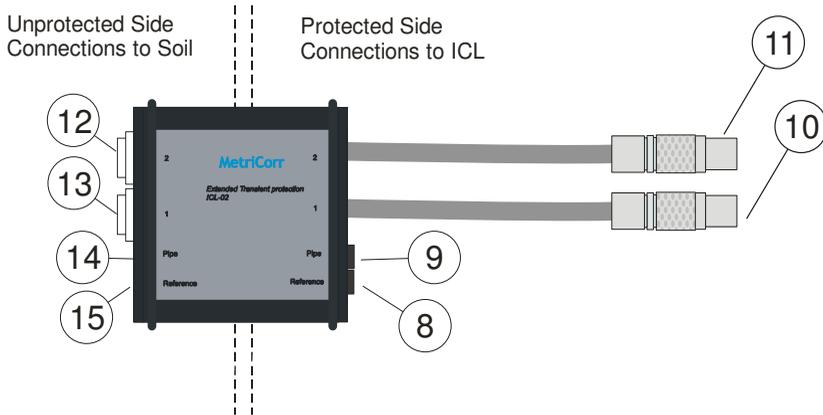
ICL-02i Connections



1. Connection for Reference electrode (through ETP)
- 2-3. Connections for ER probe no. 1 & 2 (through ETP)
4. RS232 - 9 pole female Sub D connector for serial interface to a PC
5. Green LED indicator for status information from the datalogger
 When power is applied, a short flash (0.5s) tells that the logger is alive.
 During a measurement it flashes every 2 s.
 During a fast measurement it flashes every 0.5 s.
 During communication with the PC software it lights up
 In idle mode and waiting to start next measurement, the LED is OFF
6. 12V_{DC} input - 2,5mm Jack connector. Positive (+) in the centre.
7. Socket terminal for connection to pipe - 4 mm plug



ETP Connections



Protected side (to ICL)

- 8. Reference Input on (1)
- 9. To Pipe Input (7)
- 10-11. To ER Input channels (2) and (3)

Unprotected side (to soil)

- 12-13. Connections to ER probes
- 14. Connection from pipe
- 15. Connection to Reference electrode

Installation of the M-Config PC Software

Hardware Requirements

- Intel/AMD 1.6 GHz minimum
- 256 MB RAM (512 MB recommended)
- 10 MB free disk space on hard disk prior to installation (100 MB recommended).
- Min 1024x768, 256 compatible screen (higher recommended).
- CD-ROM drive for installation of program – or internet access for download.
- 1 free RS-232 serial port or a virtual serial port through USB to serial adaptor.

Software Requirements

- Microsoft Windows® XP SP2 or higher or Windows® 7
- M-Config for logger configuration and data handling (included)
- Spreadsheet software e.g. Microsoft Excel®
- M-Report graphical presentation software is recommended
- Installed driver for the USB to RS232 Converter

Note

When installing on Microsoft Windows you must have Administrators Privileges. If you do not, please contact your local System Administrator

Installation of the M-Config PC Software

If M-Config is already in use with the M-Link Wireless Modem, this can also be used for the **ICL-02*i*** and the ICL-02. Please ensure that M-Config is V2.1.1 or later.

The M-Config software is supplied on a CD-ROM and comes complete with its own installation program.

Simply insert the CD, run the setup.exe file and follow instructions on screen.

By default the software is installed in the directory:

Default program folder\MetriCorr\M-Config

Such as: C:\Program Files\MetriCorr\M-Config

An icon appears in the programs menu and as a shortcut on the desktop.



MConfig v2.0.Ink

Note

Alternatively, the M-Config software can be downloaded from our website:

www.metricorr.com

Communication

The ICL shall be connected to the PC with the RS232 serial cable. If the computer is not equipped with a RS232 serial interface, use the USB – Serial adapter included in this package. A driver for the adaptor must be installed. Please follow the instructions provided by the manufacturer of the adapter.

The USB to serial adaptor must be connected to the ICL before connecting USB connector to the computer, otherwise the adaptor may be damaged.

In case you consider remote monitoring of the ICL, you will either need an M-Link Wireless modem or M-ip-Link for LAN network. Both can be provided by MetriCorr.

Prepare Directory for coupon (probe) certificates and data files

Before starting the measurements each ER coupon needs to be defined through the software M-Config by its serial number and the data from the certificate.

Note

Every MetriCorr ER coupon is marked with a unique serial number. The Serial number is assigned to the measurements when the ICL-02i is programmed to take measurements. Subsequently the serial number is the unique identification from this coupon. When data are managed in the M-Report software, all measurements with the same serial number will be merged, and measurements assigned to different serial numbers will show up as different ER coupons.

It is recommended to use the optional Tag field, which appears in the M-Report Data Manager.

You will save some time if - in advance – you will consider a directory (or system of directories and sub-directories) in which the certificates are saved and a directory (or system of directories and sub-directories) in which the data files are saved.

Working with ICL-02i and M-Config PC software

M-Config is used for both the ICL-02/ICL-02i and the M-Link instruments. This section describes the operation with the dataloggers ICL-02/ICL-02i. The operation of the M-Link wireless modem is described in the Paragraph “M-Config with M-Link” on Page 62

Start window:

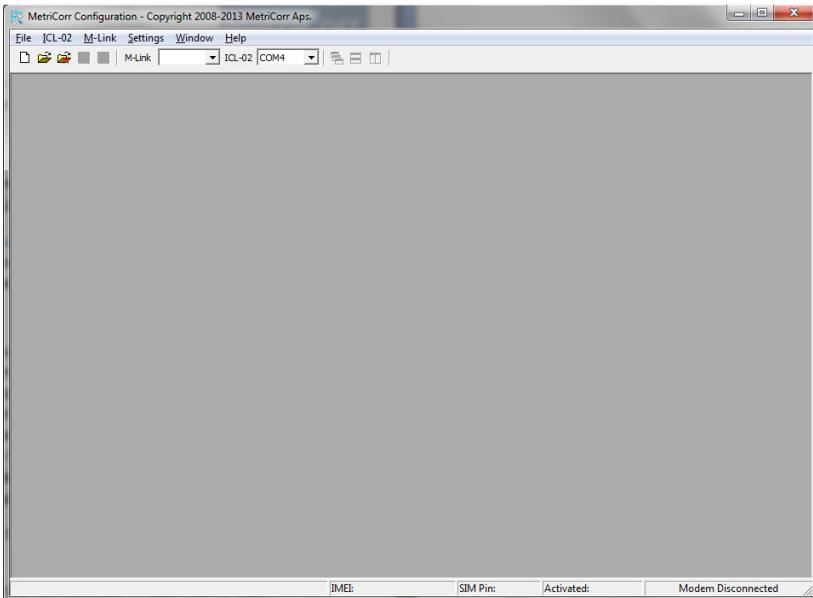


Figure 1. Start window

The M-Config software is used to configure your ER coupons / probes as well as to prepare and install a logging setup in your ICL. In the following you will be guided through the usual steps using the ICL.

The ICL can be programmed in 2 different ways:

- 1) You can pre-program the ICL in the office in advance. Subsequently in the field, simply connect the power source and the ICL will start its preprogrammed setup.
- 2) You can program the ICL on location with a laptop and verify that the first measurement results are as expected.

Either way you need to go through the same procedures as described in the following.

First steps

If you want only to configure your ER coupons (i.e. prepare certificates) you don't need to connect to the ICL – simply start M-Config from the start menu and the start window will appear on screen. Follow the procedures on page 21 - 22.

If you want to prepare and install a logging setup follow the procedures on page 23 to 31

M-Config Settings

First go into the **Settings** menu and choose **M-Config** (F11). Select a directory path for the probe certificates (extension .prb) and for data files (extension .ACD)

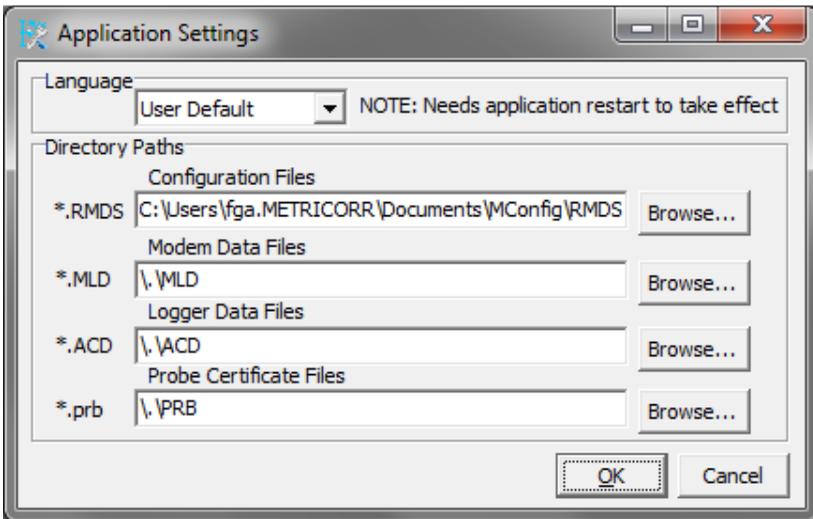


Figure 2. M-Config Settings

Language Settings

In the M-Config Settings Menu the language can be selected between those languages which have followed along with the installation. The selected language will take effect, when the M-Config software is restarted.

Directories for probe configurations and for data

The directory path is set for each of the file type that the M-Config software is handling.

Tip

You may want to prepare your directory system for certificates and data files in advance using the Windows Explorer facility.

For instance, if your pipeline system is divided into subsystems, or if you operate CP systems for different clients, you may wish to create subfolders or subdirectories reflecting the pipeline network tag system or your different clients.

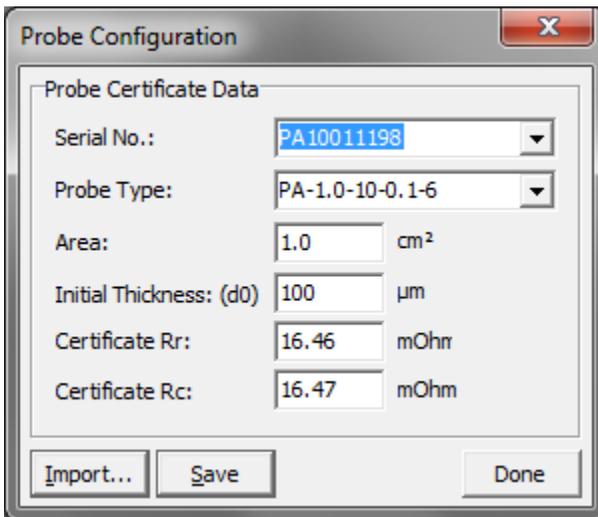
Note

No communication is made between the ICL and the computer at this point. If you want specifically to define probes (enter data from certificates) for use later, you don't need to contact the logger, and therefore no cabling is needed.

Configuring probe / coupon

For each ER coupon (ER probe) you intend to log with the ICL, you need to create a certificate file.

Choose **Settings** menu and select **Probe** (F10).



Probe Certificate Data	
Serial No.:	PA10011198
Probe Type:	PA-1.0-10-0.1-6
Area:	1.0 cm ²
Initial Thickness: (d0)	100 µm
Certificate Rr:	16.46 mOhm
Certificate Rc:	16.47 mOhm

Figure 3. Probe Configuration

You need to enter 6 characteristics of the probe you are defining, all of which are assembled at the factory certificate that comes along with the probe.

Serial number. The yellow tag made on every probe cable shows the serial number. The serial number is the unique identification from this coupon and the key, when data are subsequently managed in the M-Report software.

Probe Type. The numbers in the probe type refer to the parameters coating defect size, length to width ratio of the element, initial element thickness, and cable length.

Area refers to the area of the artificial coating defect of the coupon.

Initial thickness refers to the initial thickness of the element that forms the artificial coating defect. Usually approximately half the initial thickness can be regarded as the lifetime of the coupon for optimum corrosion rate calculation see more on page 47

Certificate Rr and **Certificate Rc** refer to the resistance of the exposed element and the coated element in a state of no corrosion accumulated on the element. These data are later used to calculate the residual thickness of the exposed element (page 12).

Save the probe data by pressing **Save**. The saved probe certificate file will have the extension .prb.

Note

It is **important** that the correct probe values are entered **before** use, otherwise the software cannot calculate results correctly.

Communicating with the ICL

When you want to operate the logger, get in contact with the logger by following these steps:

1. Connect the serial cable between the RS232 socket on the ICL to a free serial COM port on the computer or through the USB to RS232 converter to a USB on the computer².
2. Supply power to the ICL using the power adaptor. The "Status" LED on the ICL will turn on for one second.
3. Start the M-Config software from the start menu and the start window Figure 1 will appear on screen
4. Select the COM port³ which the ICL is connected to, see Figure 4.

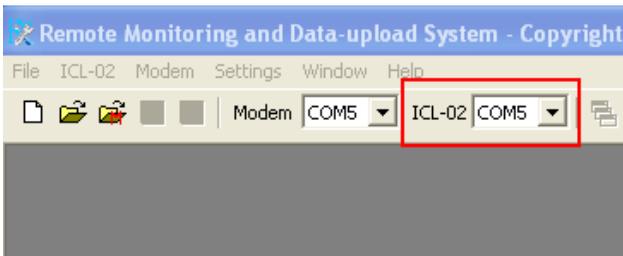


Figure 4. Select ICL COM port

² First connect the ICL to the USB-serial converter, and then plug the USB connector into the PC. Otherwise you may damage the adaptor.

³ Determine which COM port the ICL is connected to by removing USB plug from PC while observing which COM port is disappearing from the drop down menu.

ICL-02 Communication Settings

Select the menu **Settings** and **ICL-02..** (F9)

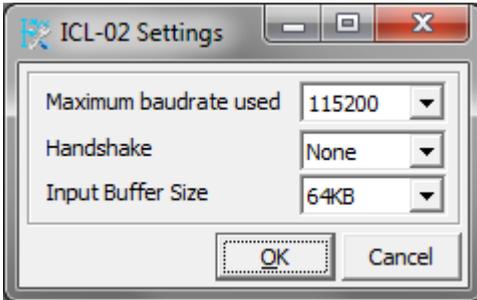


Figure 5 ICL-02 Communication Settings in M-Config

It is recommended to use the default settings in Figure 5, but if M-Config is running on a computer with low resources⁴ and if a communication problem is experienced during data upload then try one or more of the following changes:

1. Set Handshake to *Xon/Xoff*
2. Increasing the Input Buffer size⁵
3. Decrease the maximum baudrate.⁶

⁴ Low resources may be the result of running many programs at the same time. In this case stop as many of the other programs as you can before attempting a data upload

⁵ The Input Buffer size is a request from M-Config to the Windows operating system and there is no guaranty that the operating system will honor the requested buffer size.

⁶ M-Config uses the Maximum baudrate, when data is uploaded from ICL-02i to the computer. For configuration of the ICL-02i, the baudrate is always 9600 independently of this setting.

The ICL Control Panel

ICL02 Control Panel is being used to setup and start the ICL-02.

Select the menu **ICL-02** and **Start** (Ctrl +F2)

M-Config will read the current settings from the ICL and display them in the Control Panel see Figure 6.

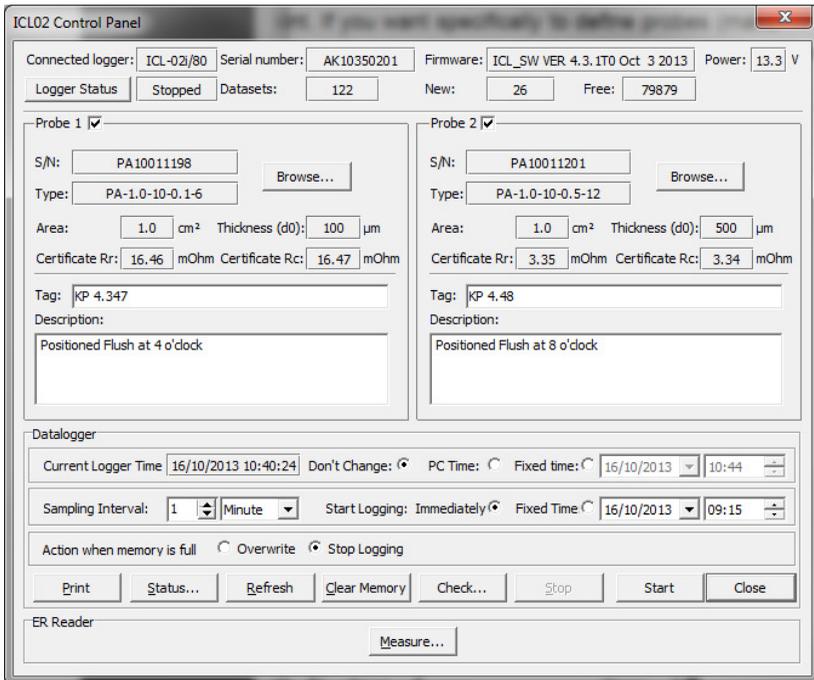
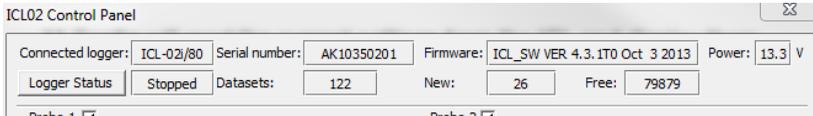


Figure 6. ICL Control Panel

Logger Information

In the top of the control panel you will find information about the logger



The screenshot shows the 'ICL02 Control Panel' window. It contains the following information:

Connected logger:	ICL-02i/80	Serial number:	AK10350201	Firmware:	ICL_SW VER 4.3.1T0 Oct 3 2013	Power:	13.3 V
Logger Status	Stopped	Datasets:	122	New:	26	Free:	79879

Figure 7. Logger Information

Connected Logger These can be:

- ICL-02: ER Range 0-640mΩ
- ICL-02i/80: ER Range 0-80mΩ
- ICL-02i/640:ER Range 0-640mΩ

Serial number

Firmware: Firmware version and issue date

Power: Voltage of the power supply measured at the latest measurement cycle

Logger Status: Refresh the information by pressing the *Logger Status* button. The Status can be

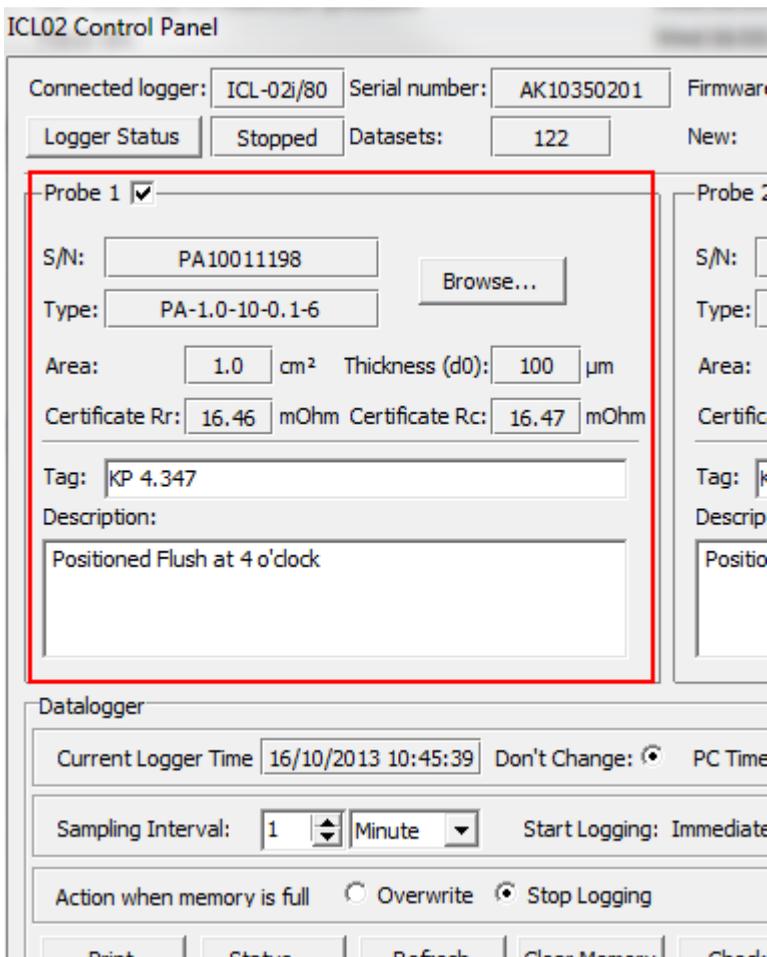
- Measuring – the measurement cycle is ongoing
- Waiting – logger is between two measurements or scheduled to start in future
- Stopped – no measurements are scheduled
- Power weak – not measuring due to a weak power supply

Datasets The total sets of measurement datasets is displayed

New: The number of datasets, that haven't been uploaded

Free: The number of remaining free dataset locations

Probe selection



ICL02 Control Panel

Connected logger: ICL-02i/80 Serial number: AK10350201 Firmware: ...

Logger Status: Stopped Datasets: 122 New: ...

Probe 1

S/N: PA10011198 Browse...

Type: PA-1.0-10-0.1-6

Area: 1.0 cm² Thickness (d0): 100 μm

Certificate Rr: 16.46 mOhm Certificate Rc: 16.47 mOhm

Tag: KP 4.347

Description: Positioned Flush at 4 o'clock

Datalogger

Current Logger Time: 16/10/2013 10:45:39 Don't Change: PC Time

Sampling Interval: 1 Minute Start Logging: Immediate

Action when memory is full: Overwrite Stop Logging

Print Status Refresh Clear Memory Check

Figure 8. Probe Selection

Select the probe channels and browse for the Probe certificate that was previously defined in page 21

For each probe, you must select the probe by the serial number present in the certificate data directory.

If the serial number (S/N) is not present in the list, you must first define the probe as described on page 21. It is essential to enter the correct serial number, because it is the key to further data analysis in the M-Report presentation software.

Complete by filling in the Tag⁷ and a description for each Probe⁸. The **tag is very useful** because it is easy to see in the M-Report presentation software.

Logging Settings

The Logging Settings are set in the control panel.

Logger Time

The Current Logger Time clock is displayed. When the logger is started, the logger Time clock will be set to from the selections:

Don't Change: The logger Time clock will not be changed

PC Time: The logger Time clock will be synchronized with the PC Time

Fixed Time: A Time can be set manually.

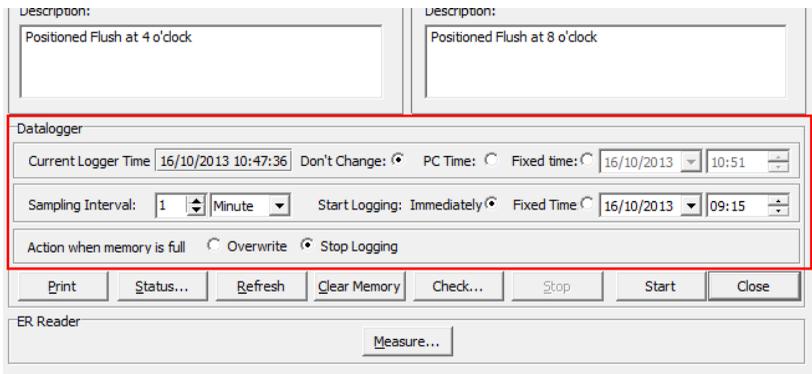


Figure 9. Logging Settings

⁷ Tag is limited to 8 characters

⁸ Only use these characters: a – z, A – Z, 0 – 9, ! " # % & / () { [] | = + ? , ; : - _

Sampling Interval

The interval between each measurement cycle can be set from 1 minute and up to 59 days. A measurement cycle includes a measurement of all parameters and lasts approximately 40s. when measuring both probes. Both probes are disconnected for about 22s during measurement

In most conditions a sampling interval no less that 10 min. is recommended.

Start Time

The start time can be chosen to be Immediately after pressing the Start button or at a fixed time.

Action when memory is full

Overwrite: Overwrites data starting from the oldest

Stop Logging: No measurement are deleted

Logger Controls

In the bottom of the Control Panel are located the Logger Control buttons.

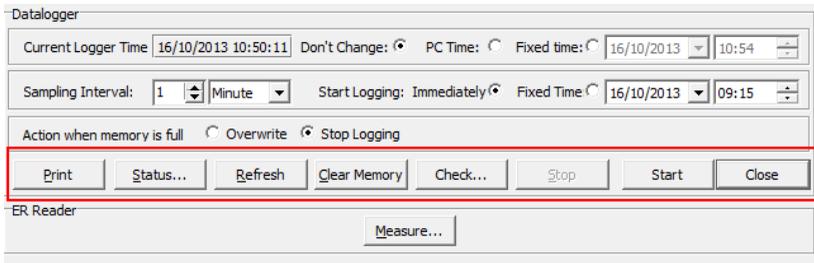


Figure 10. Logger control buttons

Measurement Check

Before starting the logger, a measurement check can be made by pressing the *Check* button. The measurement check can be used to ensure that all connection are correct, and that the measurements seem right.



Figure 11. Measurement Check Result

Note

The measurement check is **not** logged.
 Always remember to **start** logger after the measurement check.

Start

When the logger status is stopped, press the *Start* button. The logger is now loaded with the settings entered in the control panel, and the logger is started.



Figure 12. Start Button

Continue

If the logger status is measuring or waiting, press instead the *Continue* button. The logger will continue the record if only changes are made in sampling interval settings.



Figure 13. Continue button

Note

If any of the probe settings are changed, all previous datasets will be erased before starting the logger.

Clear Memory

The *Clear Memory* button erases all logged datasets in the logger and leaves the probe settings and logging settings unchanged.

Refresh

The *Refresh* button retrieves all setup information from the logger.

Status

Pressing *Status* displays in a new window an overview of logger status including results of last measurements see Figure 14.

Print

The *Print* button sends the status page to the default printer.

Logger Details

Logger Type: ICL-02V80
 FW version: ICL_SW VER 4.1.2 Feb 12 2011
 Serial Number: AK10470231
 Current Logger State: Measuring
 Current Power Supply Level: 12.0 V
 Number of readings currently in memory: 21
 Number of readings not uploaded: 3
 Memory available: 80078

Result of last measurement @ 29-03-2011, 15:10

Probe	Electrical Data						ER Probe Data			
	Uac [V]	Iac [mA]	Jac [A/m ²]	Rs [Ohm m ²]	Idc [mA]	Jdc [A/m ²]	Edc [V]	Rr [mOhm]	Rc [mOhm]	d [μm]
1	1.00	0.10	1	0.957	-0.123	-1.234	-1.183	1.01	1.00	503.49
2	1.00	0.10	1	0.957	-0.125	-1.250	-1.183	1.00	1.01	100.08

Probe specifications

	Probe 1	Probe 2
Type:	PA-1.0-10-0.5-12	PA-1.0-10-0.1-6
Serial Number:	PA10011201	PA07330475
Area:	1.0	1.0
Initial Thickness	500.0	100.0
Certificate Rr value:	3.35	16.97
Certificate Rc value:	3.34	17.04
Tag:	KP 4.347	KP 4.348
Description:	Positioned Flush at 4 o'clock	Positioned Flush at 8 o'clock

Page 1 of 1

Printed: 2011.03/29

Figure 14. Status View

ER Reader Function

The ER Reader function is a simple way to make a measurement with the ICL-02i.

Before starting an ER Reader select the probe(s) as described on page 27

Measure

Pressing the Measure button, the ICL-02i starts a single measurement and uploads the results to M-Config immediately after the measurement cycle has finished.

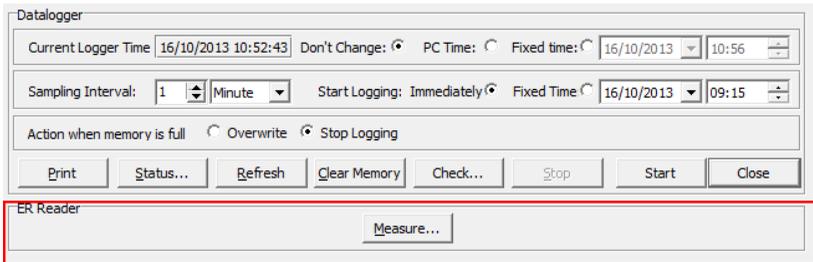


Figure 15. Starting ER Reader measurement

Note

The ER Reader function occupies the memory in the datalogger and previously recorded data and settings will be erased.

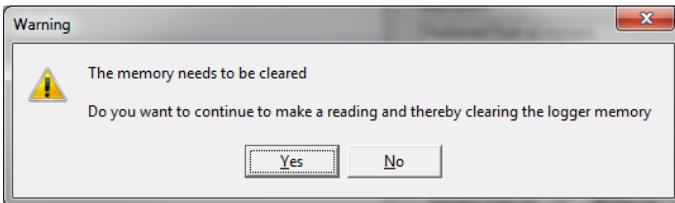


Figure 16.

Confirming the measurement start, will start a single measurement, and the results are uploaded to M-Config automatically.

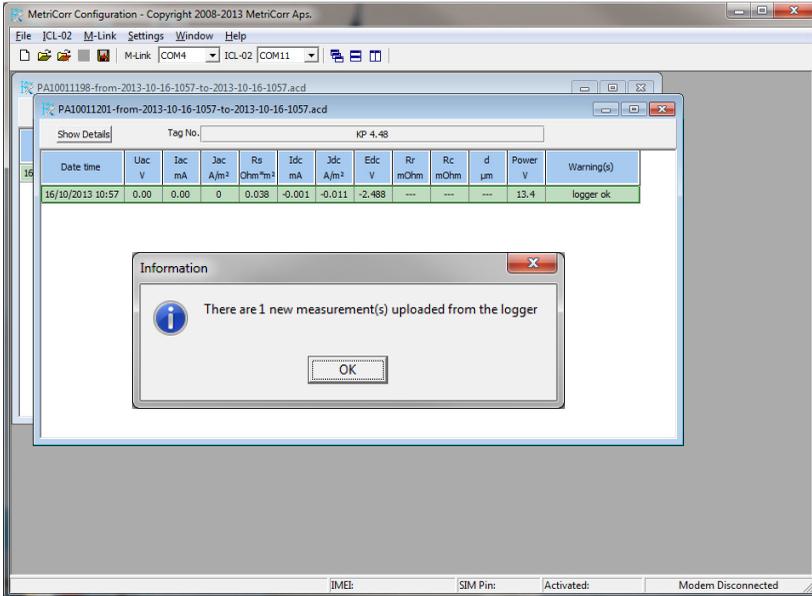


Figure 17. ER Reader data automatically uploaded after measurement

Save the files as described in page 36

Uploading data from the datalogger

Data can be remotely sent in e-mail via the M-Link Wireless modem. This is in details described in the section “*Receiving Data*” page 80.

If data are collected directly from the ICL to the PC, then the M-Config software is used for this too:

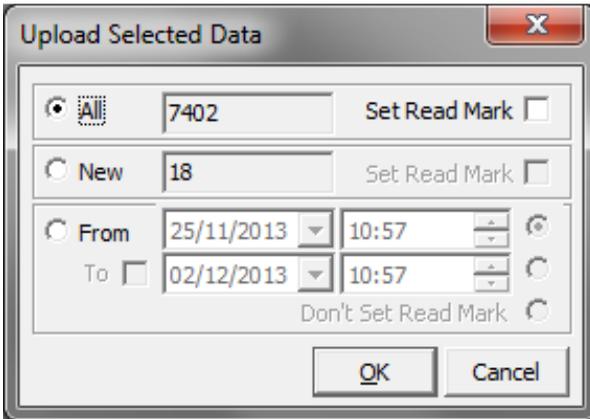
In the ICL-02 menu select one of the following:

Status Ctrl+F5

Status displays an overview of logger status including results of last measurements – see Figure 14. This is convenient to check before uploading data.

Upload Selected Data [Ctrl +F8]⁹:

Data for upload can be selected in the menu.



The options are

- **All** data from the ICL memory are uploaded to the computer. If the *Set Read Mark* is checked, then all data in the ICL memory will be marked as read.
- **New** data will only upload data that hasn't been uploaded before. If the *Set Read Mark* is checked, then all data in the ICL memory will be marked as read.
- **From – To** will upload data that is included in the specified time interval, and this will set the read mark to the latest measurement in the interval. If *Don't Set Read Mark* is checked, then the upload won't change the read mark.

⁹ **Upload Selected Data** can be done from ICL-02i firmware version **4.3.0** and later. In earlier versions only **New Data** and **All Data** can be uploaded

Upload New Data {Ctrl +F7}

Only data that hasn't been uploaded before will be uploaded from the datalogger memory to the computer.

The screenshot shows the 'Remote Monitoring and Data-upload System' window. The title bar indicates it is a MetriCorr application. The interface includes a menu bar (File, ICL-02, Modem, Settings, Window, Help), a toolbar with icons for file operations, and a status bar at the bottom with fields for IMEI, SIM Pin, and Modem status (Activated/Disconnected).

The main area displays a table of data for Tag No. KP 4.347. The table has 13 columns: Date time, Uac V, Iac mA, Jac A/m², Rs Ohm/m², Idc mA, Jdc A/m², Edc V, Rr mOhm, Rc mOhm, d μm, Power V, and Warning(s). The data rows show measurements from 29-03-2011, 15:10 to 15:22. The row for 15:16 is highlighted in green.

Date time	Uac V	Iac mA	Jac A/m ²	Rs Ohm/m ²	Idc mA	Jdc A/m ²	Edc V	Rr mOhm	Rc mOhm	d μm	Power V	Warning(s)
29-03-2011, 15:10	1.00	0.10	1	0.957	-0.123	-1.234	-1.183	1.01	1.00	503.49	12.3	logger ok
29-03-2011, 15:11	1.00	0.10	1	0.957	-0.123	-1.234	-1.184	1.01	1.00	503.35	12.3	logger ok
29-03-2011, 15:12	1.00	0.10	1	0.957	-0.123	-1.234	-1.183	1.01	1.00	503.84	12.3	logger ok
29-03-2011, 15:13	1.00	0.10	1	0.957	-0.123	-1.234	-1.183	1.01	1.00	503.51	12.3	logger ok
29-03-2011, 15:14	1.00	0.10	1	0.957	-0.123	-1.234	-1.183	1.01	1.00	503.42	12.2	logger ok
29-03-2011, 15:15	1.00	0.10	1	0.957	-0.123	-1.235	-1.183	1.01	1.00	503.48	12.3	logger ok
29-03-2011, 15:16	1.00	0.10	1	0.957	-0.123	-1.234	-1.183	1.01	1.00	503.59	12.3	logger ok
29-03-2011, 15:17	1.00	0.10	1	0.958	-0.123	-1.234	-1.184	1.01	1.00	503.40	12.3	logger ok
29-03-2011, 15:18	1.00	0.10	1	0.957	-0.123	-1.233	-1.183	1.01	1.00	503.71	12.3	logger ok
29-03-2011, 15:19	1.00	0.10	1	0.957	-0.123	-1.234	-1.183	1.01	1.00	503.76	12.3	logger ok
29-03-2011, 15:20	1.00	0.10	1	0.957	-0.123	-1.234	-1.183	1.01	1.00	503.51	12.3	logger ok
29-03-2011, 15:21	1.00	0.10	1	0.957	-0.123	-1.235	-1.184	1.01	1.00	503.43	12.3	logger ok
29-03-2011, 15:22	1.00	0.10	1	0.957	-0.123	-1.234	-1.183	1.01	1.00	503.62	12.3	logger ok

Figure 18. Data upload

Saving Files

Save data by selecting **File, Save ACD-File As..** from the File menu.

Data from each probe has to be saved in individual files, i.e. one file per window appearing when uploading data. As a default, the files will be named as a combination between probe serial number and the record period. The extension of the file is .acd, e.g.

PA10011201-from-2011-03-29-1502-to-2011-03-29-1522.acd

Note

Don't use the Save M-Link Settings function. This is for saving the configuration of the M-Link Wireless modem in the *.rmds format.

The .acd files can be imported into the M-Report data presentation and analyzing software.

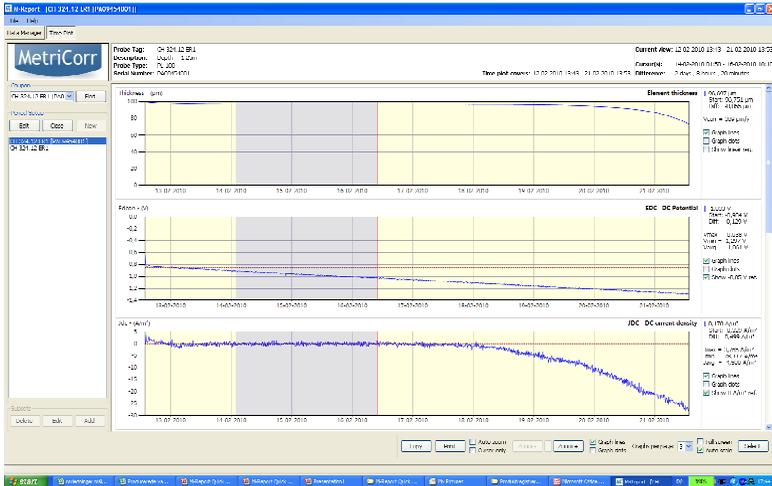


Figure 19. View from M-Report

The .acd files are in comma separated format and can also be imported into spreadsheet programs like Windows Excel®.

Installation on Site

Before installing the ICL-02i, ensure that you have a suitable test post that protects your equipment from moisture. MetriCorr has different solutions for this purpose. See Product Info sheets on www.metricorr.com.

It is recommended to establish the test post and wiring as on Figure 20 and using extended transient protection as shown on Figure 22.

If the ICL-02i is temporarily removed from the test post, then each probe must be bonded to the pipe with the ER-coupon termination cable 100055 see Figure 21 .

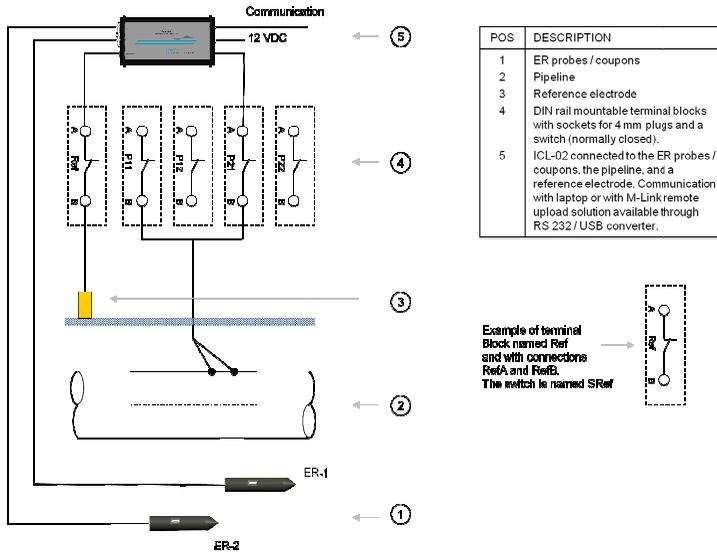


Figure 20. ER coupon Test Station (wiring) – with ICL-02i

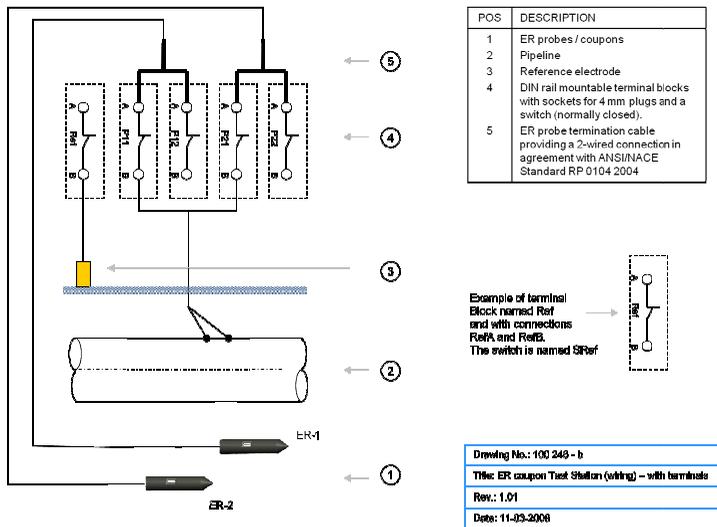


Figure 21. ER coupon Test Station (wiring) – with terminals

Protection against Electrical Surges

Recommended battery powered installation with ETP

The ICL-02i has several inputs, which are connected physically to different points around the pipe and related installations. In a situation of surges, these points will obtain a large differential voltage that will be applied to the terminals on the ICL-02i.

To protect the ICL-02i MetriCorr prescribes **to use the Extended Transient Protection (ETP)** in front of the ICL-02i. The ETP keeps the potential low between the terminals through bypassing the surge current to the pipe connection. This improves the protection, even though lightning close enough and strong enough may still damage the instrument, as it will damage any instrument experiencing the same.

When the ICL-02i is installed in e.g. a test post with a battery supply and no other connections to earth than through the reference cell (5), through the coupons (4) and the pipe connection (9), then the differential surges between these lines could damage the ICL-02i. The Extended Transient Protection (ETP) improves the protection against these differential surges.

However the ICL-02i including its Power input and connected equipment must be floating and properly isolated with reference to ground. For more detailed information on protecting the installation and especially for **Mains Powered Installations** see the document *100489 ICL-02i Installation Guidelines*

Legends

1. ICL-02i
2. ETP
3. Battery
4. Coupons connected to ICL02i and buried in the soil next to the pipe
5. Reference Cell
6. Housing / test post electrically insulated from environment
7. Pipe
9. Connection point of pipe connection (typical in a test post)
21. Wire from Pipe to Pipe connection point
22. Wire from Pipe Connection point to ETP

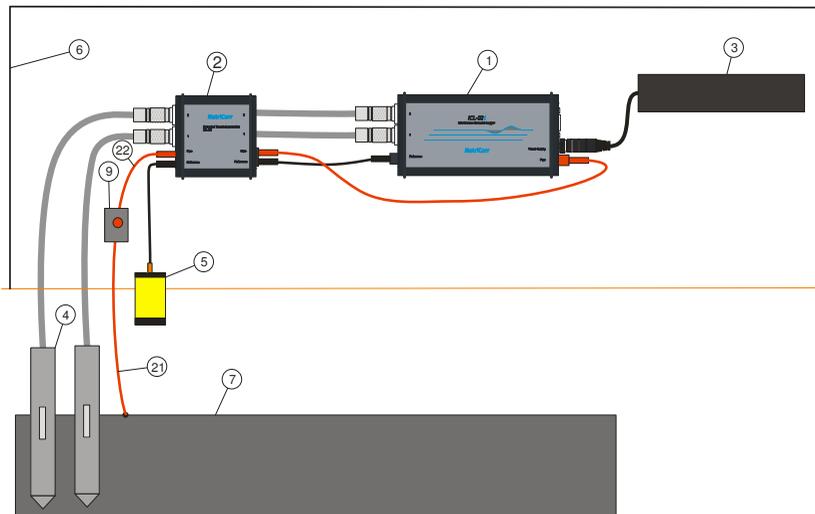


Figure 22. Transient Protection of a Battery Powered Installation

For more detailed information please see the document 100489, "ICL-02i Installation Guidelines"

Technical descriptions

In the following sketches is illustrated how the internal connections are during all the measurements.

The previous ICI-02 and the new ICL-02i are slightly different in the way they are performing the voltage measurements.

System idle

In idle mode between the measurements, both coupons are connected through the logger to the Pipe connection. The Reference electrode is disconnected.

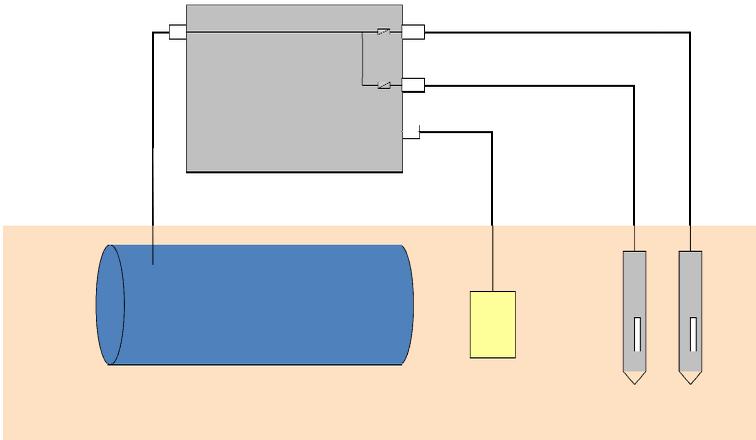


Figure 23. ICL-02 and ICL-02i system idle

ICL-02 Current and Voltage Measurements

The ICL-02 makes the current measurement and voltage measurements separately. The Voltages (E_{DC} and U_{AC}) are measured between the Reference Electrode and the Pipe while the probes are disconnected from the Pipe see Figure 25.

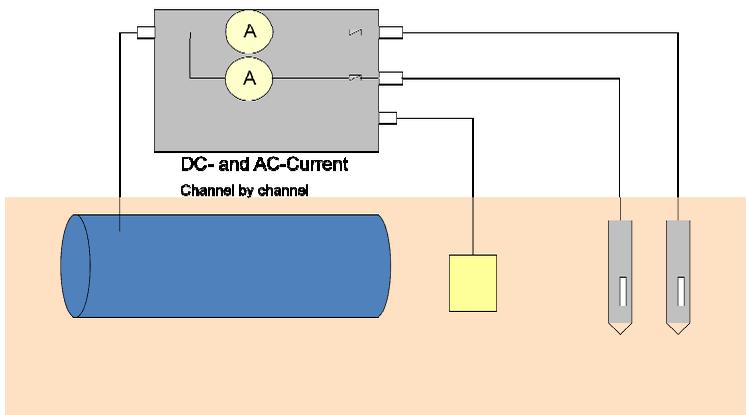


Figure 24. ICL-02 Current Measurement

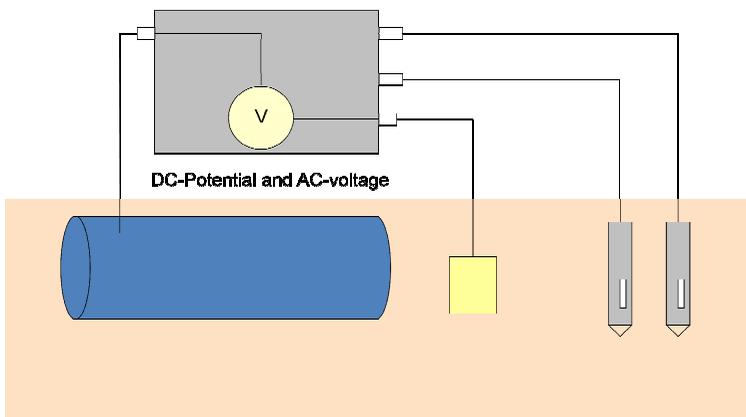


Figure 25. ICL-02 Voltage Measurement

ICL-02i Current and Voltage Measurements

The ICL-02i differs from the ICL-02 by having the probes connected to Pipe while both currents and voltages are measured simultaneously. This gives a better correlation between current and voltage when the spread Resistance R_s is determined.

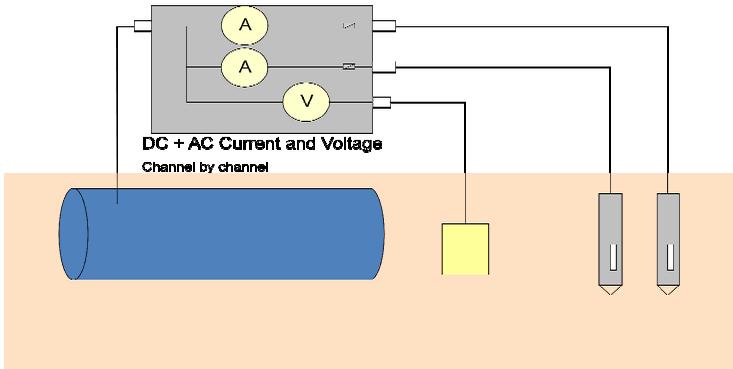


Figure 26. ICL-02i voltage and current measurement

ER Measurement

While the ER measurement is performed, each probe is disconnected in approximately 22s.

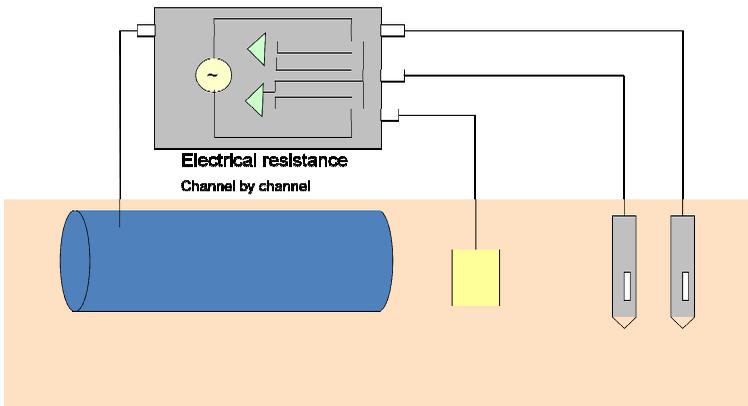


Figure 27. ICL-02 and ICL-02i ER measurement

Data Assessment

When the data are evaluated you should be aware that the following incidents can influence the data.

Battery Weak

Before each measurement, the power source is checked by the ICL-02i. If it is too weak to perform an ER measurement, then the scheduled measurement will be omitted. This is repeated before each scheduled measurement, and when the power is strong enough, the measurements will be continued.

During the time period with a power weak condition, there will only be 2 measurements and they will solely contain Power Weak indication – one when it starts and one when it ends.

Show Details													Tag No. KP 4.348	
Date time	U _{ac} V	I _{ac} mA	J _{ac} A/m ²	R _s Ohm/m ²	I _{dc} mA	J _{dc} A/m ²	E _{dc} V	R _r mOhm	R _c mOhm	d μm	Power V	Warning(s)		
29-03-2011, 15:27	1.00	0.10	1	0.958	-0.125	-1.250	-1.183	1.00	1.01	100.02	11.0	logger ok		
29-03-2011, 15:28	1.00	0.10	1	0.957	-0.125	-1.250	-1.184	1.00	1.01	100.07	11.1	logger ok		
29-03-2011, 15:29	0.00	0.00	0	OL	0.000	0.000	0.000	0.00	0.00	OL	10.1	LOGGER FAULT: Power Weak		
29-03-2011, 15:29	0.00	0.00	0	OL	0.000	0.000	0.000	0.00	0.00	OL	10.1	LOGGER FAULT: Power Weak		
29-03-2011, 15:30	1.00	0.10	1	0.958	-0.125	-1.250	-1.184	1.00	1.01	100.05	10.7	logger ok		
29-03-2011, 15:31	1.00	0.10	1	0.958	-0.125	-1.249	-1.183	1.00	1.01	100.06	10.7	logger ok		

Figure 28. Power Weak indication in datafile

The minimum requirements of the power source are

Minimum DC Voltage = 10.5V

Maximum Internal Resistance = 7Ω

Reference electrode gets dry

If the reference electrode gets dry, its resistance increases. This will lead to an error on the E_{dc} and U_{ac} measurements. If the resistance is comparable with the input resistance of 2.2MΩ, then the reading of E_{DC} will go towards -2.5V and U_{ac} towards 0V

In Figure 29 is shown the effect of an increased resistance of the reference electrode. For comparison is also displayed the reading from an Agilent 34401A multimeter in a similar situation.

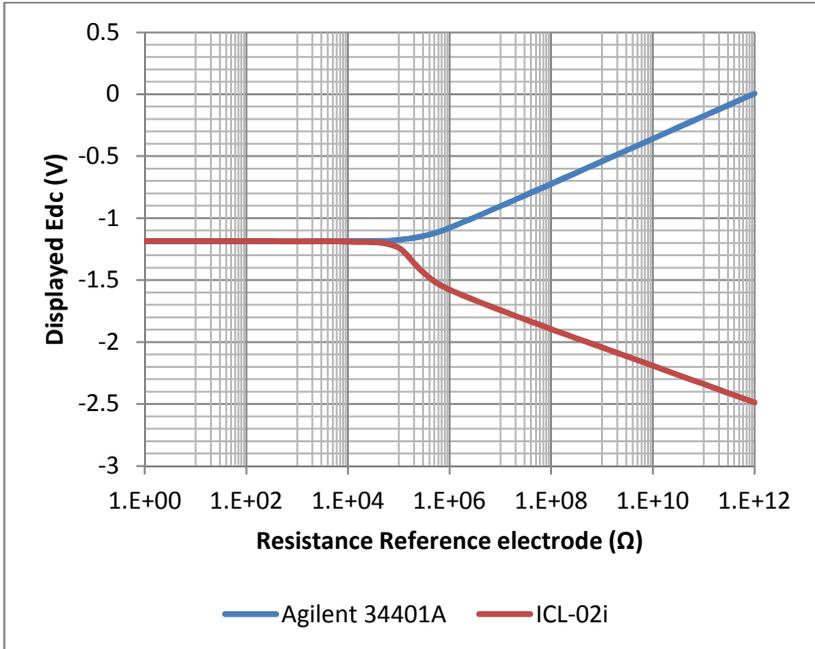


Figure 29. Effect on E_{DC} from increased Reference electrode resistance

Blown Fuses

The instrument is protected with a fuse in each probe channel. If one of these fuses is blown, I_{DC} and I_{AC} will be 0mA. The Voltage measurements will still be showing the pipeline voltage.

The logger will still be able to measure the ER values and the thickness of the coupon, but because the fuse is blown, the **coupon** will now be **disconnected** from the pipe and does not have same potential as the pipe and is left to **corrode freely without CP**.

A guide for changing fuses is found on page 49

Pipe disconnected from logger

If the wire between the logger and the pipe is disconnected, then the ICL-02i will measure E_{DC} as the free potential on the coupon. You will see that U_{AC} , I_{AC} and I_{DC} will all be close to zero.

The coupon is left to **corrode freely without CP**.

If more than one ICL-02i have their pipe connector wired together, but the common pipe connection is broken, then equalization current will flow between the probes, and they will achieve a common potential.

Probe and Reference connection mixed up

If by a mistake the two connections to pipe and Reference are interchanged, then there is a risk of spoiling the ER coupons. The coupons will instead be connected to the Reference electrode that has an anodic potential relative to the coupon, and the coupons will therefore corrode very quickly.

ICL-02i will measure E_{DC} as the common potential of Reference electrode and the coupon assumable close to 0V.

ICL-02 will measure E_{DC} between Reference electrode and Pipe but with opposite sign assumable a positive value.

Coupon condition

Usually approximately half the initial thickness can be regarded as the lifetime of a coupon for optimum corrosion rate calculation. At this point the ER value of R_C is approximately twice the initial value. For most ER coupons this is well within the dynamic range of the ICL-02i/80 of 80m Ω (or ICL-02i/640 of 640m Ω). Even beyond this point, the coupon can still tell if the corrosion is within control.

However when the coupon continues to corrode, eventually R_C will reach full scale (FS) (80m Ω or 640m Ω), and the thickness reading will be invalid.

When the Coupon is fully corroded, then it will disconnect and no measurement current can flow in the coupon. Therefore the R_R will also display FS.

Battery Selection Examples

Idle mode Consumption	0.7 mA	X	1500 h	1050 mAh
Measurement consumption	0.8 mAh	X	9000	7200 mAh
Total				8250 mAh

Table 1. Logging every 10 minutes in 1500 hours (62 Days)

Idle mode Consumption	0.7 mA	X	4400 h	3080 mAh
Measurement consumption	0.8 mAh	X	4400	3520 mAh
Total				6600 mAh

Table 2. Logging every 1 hours in 183 days (6 months)

Idle mode Consumption	0.7 mA	X	8766 h	6136 mAh
Measurement consumption	0.8 mAh	X	365	292 mAh
Total				6428 mAh

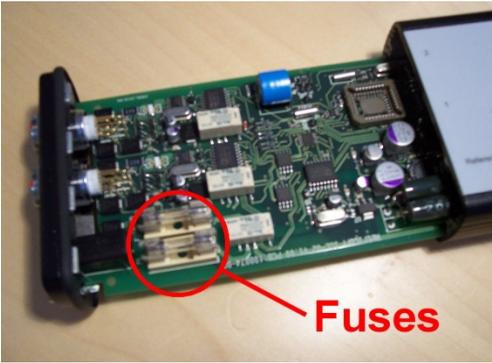
Table 3. Logging every 1 day in 365 days (1 Year)

Alternatively, the ICL-02i can be powered from a solar cell system. MetriCorr has different solutions for this purpose. See Product Info sheets on www.metricorr.com.

Change of Fuse

The instrument is protected with a fuse in each coupon branch.

In case a fuse is blown, it is easily changed :

1. Use the sharp point of a knife to draw out the two black caps hiding the screws in the cover shown in the pictures.
2. Use a Torx 10 to unscrew and pull out the lid including the Printed Circuit Board
3. Replace the fuse with a 316 mA T, 5x20 mm glass type.
4. Reassemble the Printed Circuit Board into the cabinet using the lowest track in the profile. Ensure that the internal wire to the DC connector can move freely and is not squeezed.
5. Tighten the screws and press the caps upon the screws.

Technical Data ICL-02i

@ 23°C±3°C

ER resistance		
TCR, -20°C – +60°C	< ±1 ppm/°C	
Drift	< ±1 ppm/y	
Version	ICL-02i/80	ICL-02i/640
Range	0 – 80 mΩ	0 – 640 mΩ
Repeatability (2σ)	0.4 μΩ	1.4 μΩ
Precision (4σ)	0.8 μΩ	2.8 μΩ

Connections	
Communication	Serial RS232 subD (f) 9 pin
Pipe / Reference	Safety socket 4 mm
ER probe	ODU mini snap socket, 10 pin
Power	2.5 x 5.5 mm DC socket

Voltage	
Range	100 V
Resolution	1 mV
AC accuracy	± 1 mV ± 1% rdg.
DC accuracy	± 1 mV ± 1% rdg.
Input resistance	2.2 MΩ

Current	
Range	300 mA _{rms}
Resolution	1 μA
AC accuracy	±4 μA ± 1% rdg.
DC accuracy	±1 μA ± 1% rdg.
Shunt resistance	20 Ω

General	
Storage capacity	80,000 readings
Logging frequency	Max. 1 per minute
Power requirement	11 – 15 V, 1A
Idle mode current @12V	0.7mA
Consumption measuring 2 probes @12V	0.8mAh/measurement
Operating conditions	-40 – +60°C 0 – 95 % RH non condensing
Transient protection	1100 V for 150 ms
Weight	400 g
Size L x W x H	185 x 82 x 35 mm

<u>Options</u>	<u>MetriCorr order no.</u>
Test post SolarTEC	100401
Extended Transient Protection 20 kA – 8/20 µsec	100215
M-Report Personal license, max 10 coupons	100353
M-Report Corporate, Clients Oracle, max 10 coupons	100358
M-Link Wireless modem, pack	100235
M-ip-Link Datanet connectivity LAN/WLAN	100230
Battery pack, DC plug, long 15 V, 16 Ah	100159
Battery pack, DC plug, box 15 V, 16 Ah	100192
Instrument shoulder bag	100088
Power cable for car socket	100157
Converter ODU (m) to MIL C5015 (f)	100394
ER-coupon termination cable	100055
Horizontal wallmount for DIN NS35	100142
Vertical wallmount for DIN NS35	100143
AC/DC Adaptor Power Supply Class I, 100-240V/12V	100085
AC/DC Adaptor Power Supply Class II, 100-240V/12V	100500

Regulatory Information

The ICL-02i meets the requirements of the EU directives listed below:

- LVD 73/23/EEC
- EMC Directive 89/336/EEC
- RoHS Directive 2002/95/EC

Test standards

Emission: Product family standards EN 61326-1; 1997 + A1, A2 and Corr.. Measurement, control and laboratory equipment
Product standards;
EN 61000-3-2/2000 and
EN 61000-3-3/1995

Immunity: Product family standards EN 61326-1; 1997 + A1, A2 and Corr. Measurement, control and laboratory equipment

Standards of the Ministry of Information Industry of the People's Republic of China

SJ/T 11363-2006 "Requirements for Concentration Limits for Certain Hazardous Substances in Electronic Information Products" (2006-06).

SJ/T 11364-2006 "Marking for Control of Pollution Caused by Electronic Information Products" (2006-06).



According to the "Chinese Administration on the Control of Pollution caused by Electronic Information Products" (ACPEIP) the EPUP, i.e., Environmental Protection Use Period, of this product is 20 years as per the symbol shown here, unless otherwise marked. The EPUP is valid only as long as the product is operated within the operating limits described in this manual.

Please see Table below for an overview of toxic or hazardous substances or elements that might be contained in product parts in concentrations above the limits defined by SJ/T 11363-2006.

部件名称 Name of the part	有毒有害物质或元素 Hazardous substances					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
金属部件 (Metal Parts)	○	○	○	○	○	○
电路模块 (Circuit Modules)	X	○	○	○	○	○
电缆及电缆组件 (Cables and Cable Assemblies)	○	○	○	○	○	○
塑料和聚合物部件 (Plastic and Polymeric parts)	○	○	○	○	○	○

O:
表示该有毒有害物质在该部件所有均质材料中的含量均在SJ/T11363-2006 标准规定的限量要求以下。
Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in SJ/T11363-2006.

X:
表示该有毒有害物质至少在该部件的某一均质材料中的含量超出SJ/T11363-2006标准规定的限量要求。
Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part *might exceed* the limit requirement in SJ/T11363-2006.

ICL-02i CT

Optional Analog ER Outputs

The ICL-02i CT enables the logger to work as a Corrosion Transducer. The thickness of the ER Coupons comes as analog outputs that easily can be read from another data logging system or simply a multimeter.

Additional accessories:

Test leads, Sub-D to 4mm safety plugs, MetriCorr Item no. 100440

Operation with the CT outputs

The ICL-02i CT is configured with a PC the same way as the standard ICL-02i.

Probe selection

Probes must be configured with the certificate values to give the correct output indication. When the certificate values of the ER coupon are entered for each probe, then the initial thickness will be measured to be equal the nominal thickness. The CT output will then be 100% = 2.25V.

Example:

100 μ m probe: $100\mu\text{m} = 100\% = 2.25\text{V}$

500 μ m probe: $500\mu\text{m} = 100\% = 2.25\text{V}$

Sample interval

The logger will update the CT outputs each time a new measurement is sampled. In other words the CT outputs keep the same analog values until a new measurement is sampled. If the power has been turned off in between two measurements, then the output will be 0V, until the next measurement is sampled.

Reading the CT outputs

When the logger has been configured and started from the PC, then disconnect the RS-232 cable between the ICL-02i CT and the PC and replace it with the Sub-D to 4mm safety plugs test leads. The outputs can then be measured on the plugs.

Output values

The output readings can be translated into these conditions of the ER coupon

Output value	Condition
2.25V	100% ER thickness
1.25V	50% ER thickness (normal lifetime limit)
0.25V	0% ER thickness (normally the ER film will be disconnected before 0% is reached)
0V	Missing value or power off condition
2.5V	Missing Probe or when the ER film is fully corroded

CT Output Specifications

Analog Outputs	
Range	0 - 2.5V
Maximum Load	± 5mA
Resolution	0.6mV
Accuracy	±(5mV+0,4% rdg)
Current consumption (additional to standard ICL-02i)	0.4 mA
Connections (Sub-D)	
Common (GND)	Pin 5
Channel 1	Pin 1
Channel 2	Pin 9

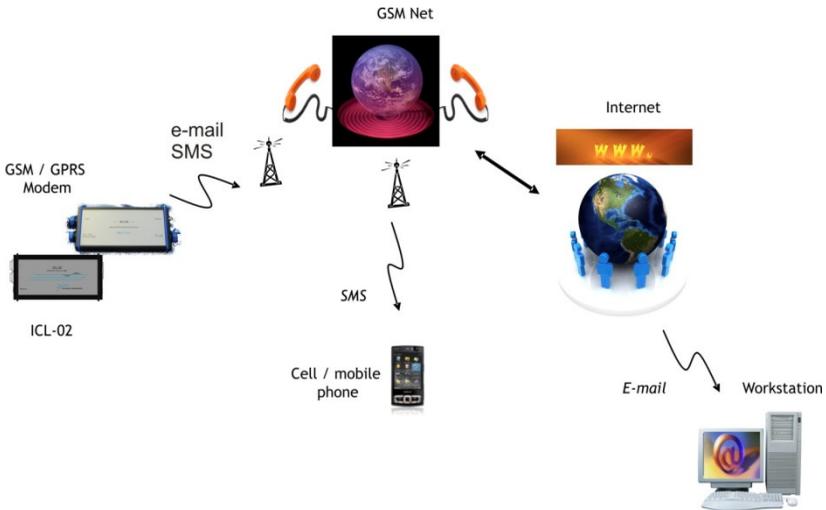
M-Link

Remote ICL Data Transmission with M-Link

M-Link is intended for passing status and transferring data from ICL-02 dataloggers installed in remote test posts to a PC located at the operators premises. The ICL and M-Link may be programmed in advance and when powered up at the test post the logging of data as well as the data transfer is initiated.

The data transfer is made by email. Status messages from M-Link can be sent by e-mail or as text messages to a mobile / cell phone.

In practice, The M-Link (Modem) is pre-programmed to upload new data from the ICL-02 datalogger and to send these data as a file via the GSM net through the internet to a workstation. From this point, the files are processed as normal files from the ICL-02 datalogger.



Connections and Indicators



External

1. Optional DC input for power supply (11 – 15 V; MetriCorr solution recommended)

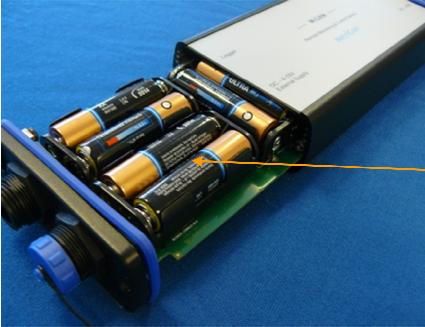
2. Antenna

3. Green LED for status indications:

- Permanently off: Power down mode, Idle or OFF
- 600 ms on / 600 ms off: Limited network service, No SIM card inserted or no PIN entered, network search in progress, ongoing user authorisation, or network login in progress.
- 75 ms on / 3 s off: IDLE mode: The modem is registered to the GSM network. No call is in progress.
- 75 ms on / 75 ms off / 75 ms on / 3 s off: One or more GPRS PDP contexts activated.
- 500 ms on / 50 ms off: Packet switched data transfer in progress

4. USB interface to a PC

5. RS232 for serial connection to ICL-02 datalogger



6



7

Internal

6. Battery holder for 6 AA batteries

7. Sim card holder.

USB Driver Installation

The first time an M-Link is connected to the PC's USB port then a USB driver shall be installed on the PC. A "Found New Hardware Wizard" will appear. Let the wizard install the software automatically. The PC needs to be connected to the internet during the installation in order to load the driver. Once the driver has been installed on the PC, this will hereafter be able to connect to any M-Link.

Note that you need to be connected to the internet to get the driver installed.

Steps to follow to Operate the M-Link with ICL

1. Supply the M-Link (Modem) with a SIM card and batteries (see 60).
2. Connect the antenna
3. Make connection between the PC and M-Link using the PC - M-Link USB cable (100239) – When M-Link is connected for the first time a driver will be installed.
4. Start M-Config and connect to the M-Link (see page 62).
5. Ask M-Link for a status (optional - see page 64).
6. Set M-Link time (optional - see page 65).
7. Retrieve settings from M-Link (optional – see page 75).
8. Define M-Link settings from configuration templates (see page 76).
9. Define time schedules for data reports and for status reports (see page 71).
10. Key in M-Link communication settings (GSM and e-mail – see page 67).
11. Key in data for mobile / cell phone receiving the text (SMS) messages (see page 72).
12. Key in E-mail data for receiving Status – and Data Reports (see page 72).

13. Send the Settings to M-Link (see page 76).
14. Activate M-Link (Start operating – see page 78).
15. Disconnect USB cable from M-Link and connect M-Link to ICL-02i¹⁰ through the M-Link Logger cable (100326)
16. Receive text messages on the cell / mobile phone (see page 80).
17. Receive data as attachments to e-mails (see page 84) and e-mail status messages (see page 82).

Inserting SIM card and batteries

The M-Link (Modem) must be supplied with a SIM card in order to communicate.

The SIM card must be able to support transmission of Text messages (SMS) and e-mails with attached files – ask your service provider for this feature.

1. Open the M-Link cabinet in the side which is marked with the label. Use the sharp point of a knife to draw out the two black caps hiding the screws.



¹⁰ The ICL-02 logger must be programmed before final connection to M-Link (see the ICL-02 Section from page 19)

2. Use the supplied Torx 10 bit to unscrew and pull out the lid including the Printed Circuit Board with the battery compartment
3. Insert 6 x AA alkaline batteries in the battery compartment
4. Place the SIM card in the SIM card holder that is placed on the back side of the battery compartment.
5. Reassemble the Printed Circuit Board into the cabinet using the second lowest track in the profile.



When ordering the SIM card from your Service Provider make sure to acquire the information apparent on page 68 .

Note:

When the M-Link is not powered for more than approx. 2 min. neither from the internal batteries nor from an external power supply, then the internal Real Time Clock will reset, and will have to be set again.

To see how the time is set in M-Link, read the paragraphs Set the M-Link Time on page 65 and *Time Synchronization* on page 74

M-Config with M-Link

Double-click on the M-Config shortcut icon to open the program.

Select the M-Link COM port. A list of available COM ports is shown¹¹. The COM port with an M-Link is only appearing in the list, as long as M-Link is connected to a USB connector on the PC.

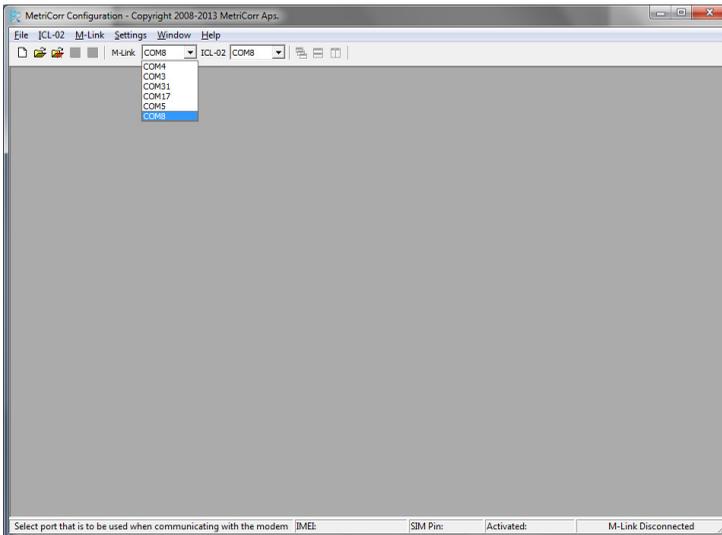


Figure 30. Select M-Link COM port

¹¹ Other devices that have a COM port on the PC are also visible in the list.

In the *M-Link* Menu select *Connect* (F2)

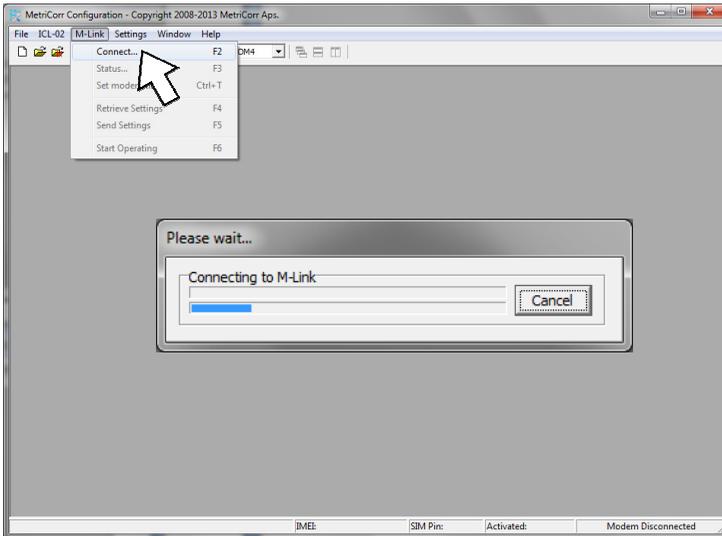


Figure 31. Connecting M-Link

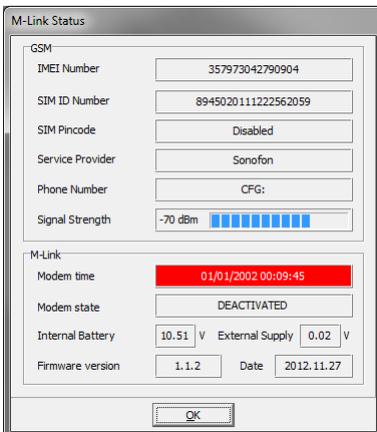


Figure 32. The Status window appears when M-Link is connected

Status Menu

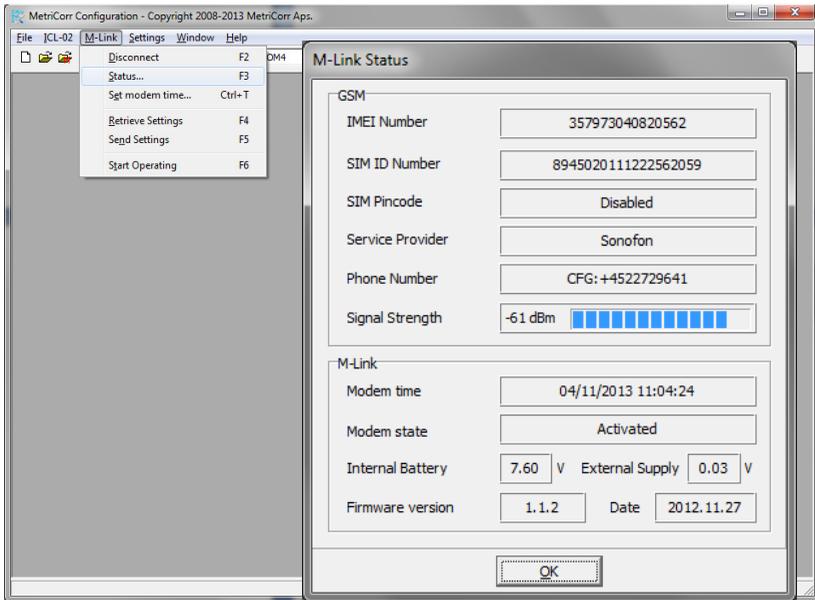


Figure 33. M-Link Status Menu

The Status Window can also be called by the “M-Link – Status “ Menu (F3)

GSM

1. IMEI Number is a unique identification code of each M-Link
2. SIM ID Number is a unique identification of the SIM card
3. SIM Pin code field can display the following information:
 - a. Disabled: the SIM card does not require a pin code (recommended).
 - b. Accepted: The entered pin code is valid.
 - c. Missing: A pin code was expected but, but none was keyed in.
 - d. Refused: The entered pin code was not accepted.
 - e. PUK: The SIM card requires the PUK code.
4. The Service Provider indicates the Service Provider to which the M-Link is currently connected. If this field states “No Service provider”, the M-Link is not connected to a network.
5. Phone Number is the phone number registered in M-Link. This can be entered as described in page 74
6. Signal Strength indicates the received signal strength from the network.

M-Link

1. Modem Time
2. Modem state indicates whether the M-Link is operating or not (ACTIVATED / DEACTIVATED)
3. Internal Battery shows the Voltage of the inserted batteries.
4. External Supply show the Voltage of the alternative externally connected power supply.

Note: If the Modem time differs from the actual time, the time can be adjusted (see page 65).

Set the M-Link Time

If the M-Link time is different from the actual time it is necessary to adjust. When asking for a status, the M-Link time is presented in red background, if the time needs adjustment. If not, the time is within +/- one minute of the PC time see Figure 32.

Select the menu *M-Link* and *Set modem time* (Ctrl+T)

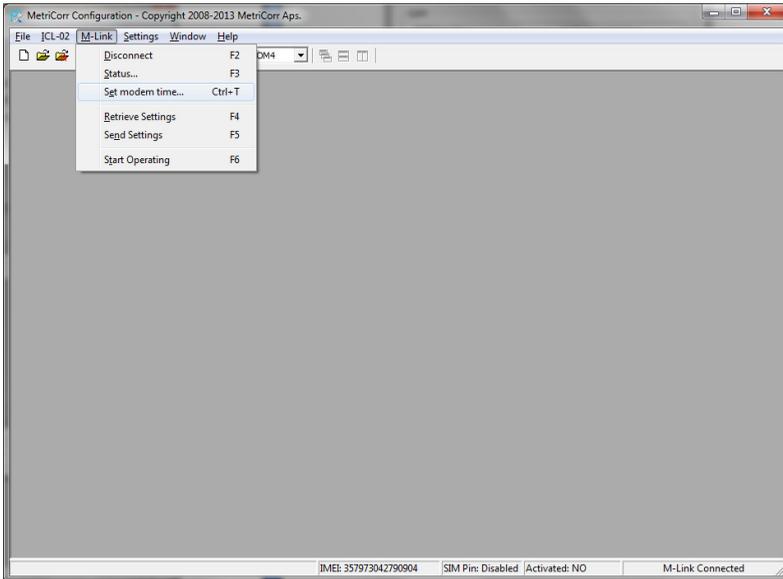


Figure 34. Set M-Link Time



Clicking “PC clock” the Modem time will be set to present PC time

Clicking “Fixed time” the Modem time can be set manually

Defining M-Link Settings

The M-Link may be programmed in either of three ways:

1. By retrieving settings from the M-Link and use these as they are or use them for inspiration to the next set of settings. See page 75.
2. By opening an .rmds template configuration file and use the settings from this file either directly or as an inspiration for a new set of settings. See page 76.
3. By keying in a completely new set of settings (communication settings, time schedules, e-mail addresses and phone number for cell / mobile phones that will receive the Status- and Data Reports). See instruction in the following pages.

M-Link Communication Settings

The following settings are necessary for transferring Data Reports and Status Reports from the M-Link.

Select the Setting M-Link menu..

And choose Communication.

The following settings are necessary for transferring Data Reports and Status Reports from the M-Link.

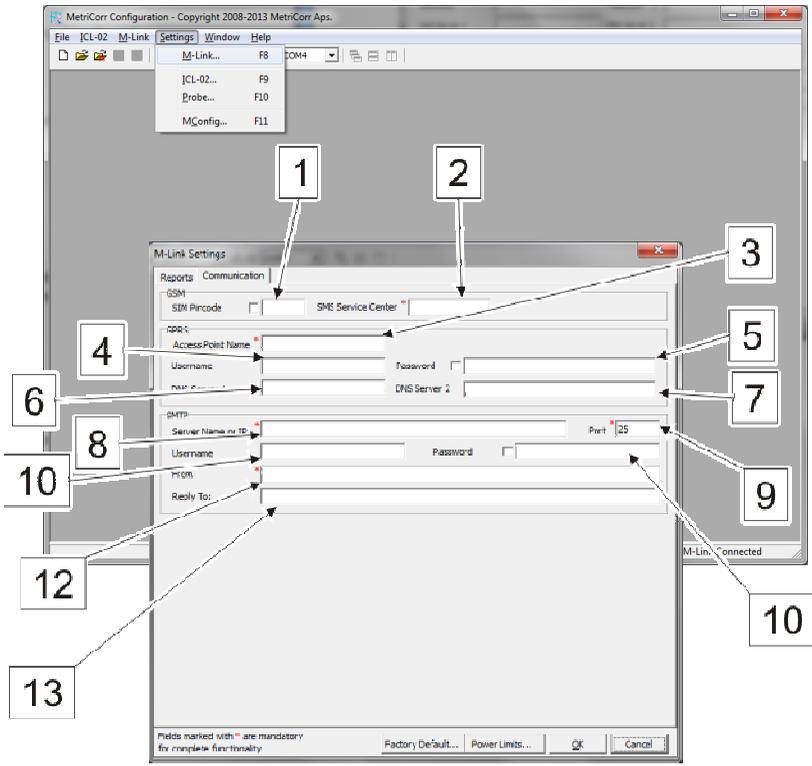


Figure 35. M-Link Communication Settings

1. Enter the SIM cards PIN code in case this is required by the SIM card. Check box to display digits. See remarks on PIN code status in the *Status Menu* Chapter on page 65.

The SIM card request for PIN code can be enabled or disabled by inserting it in an ordinary mobile phone and change it through its setup.

2. Enter the phone number for the service providers SMS service. This information is mandatory. The phone number is provided by your Service Provider. An international number format must be applied

3. Enter the name of your Service Providers internet access point. This information is mandatory. The name is provided by your Service Provider.
4. User name to be used with the Service Providers internet access point can be entered. The information is optional, but the Service Provider may specify a user name and in such case the information is mandatory.
5. Password to be used with the Service Providers internet access point can be entered. The information is optional, but the Service Provider may specify a pass word and in such case the information is mandatory.
6. IP address of the primary DNS server made available by the Service Provider can be entered. This field is optional but if the Service Provider publish an address it is advisable to use it.
7. IP address of the primary DNS server made available by the Service Provider can be entered. This field is optional but if the Service Provider publish an address it is advisable to use it.
8. Enter the IP address or the domain name of the SMTP-server made available by the Service Provider. This field is mandatory. If not entered correctly, the e-mail reports will not be sent. When roaming, this must be the information relating to the roaming Service Providers SMTP-server.
9. Enter the port on which the SMTP server is listening. The number is mandatory and is usually 25.
10. User name to be used with the SMTP server can be entered. It is optional, but the Service Provider may specify a User name and in such case it is mandatory.

11. Password to be used with the SMTP server can be entered. It is optional, but the Service Provider may specify a Password and in that case it is mandatory.

12. Enter a VALID e-mail address. The field is mandatory. The field defines a sender of the e-mails and the address receives service messages from your Service Provider, such as notification on delayed e-mails.

13. A VALID e-mail address can be entered. The field is optional. The field defines a receiver of the e-mails that someone would try to send as a reply to e-mails sent from the M-Link.

The above information should be provided by your Service Provider when purchasing the SIM card or it is usually made available on the Service Providers home page.

Defining Time Schedule Reports

Open *Setting* and *M-Link* and select the *Reports* Tab

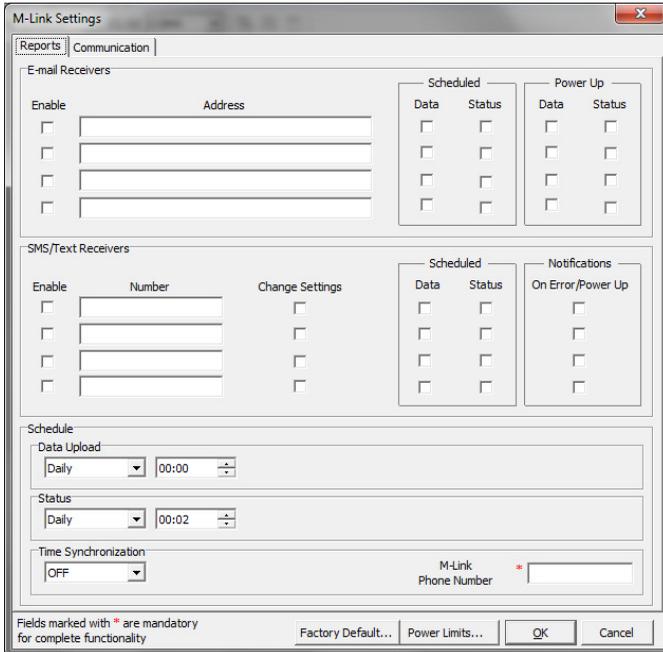


Figure 36. Reports tab

For both of these types of report (e-mails and SMS/text messages) one can select a daily report (which can be repeated 4 times a day by enabling “Repeat every 6 hours), a weekly report by selecting a weekday and a time of this day, a monthly report which can be turned into a report every other month by selecting date = 31. Also, by enabling on “Power Up” for example in the Status Report Schedule, you will be able to program all from the office and get a text message to control all is OK when the device is powered up in the field. The term “Power Up” in this context covers this procedure:

- Power off the **ICL-02/ICL-02i**
- Wait 5 sec.
- Power on the **ICL-02/ICL-02i**

E-mail Settings

The following settings regarding E-mails have to be entered in order to receive E-mail messages from the M-Link

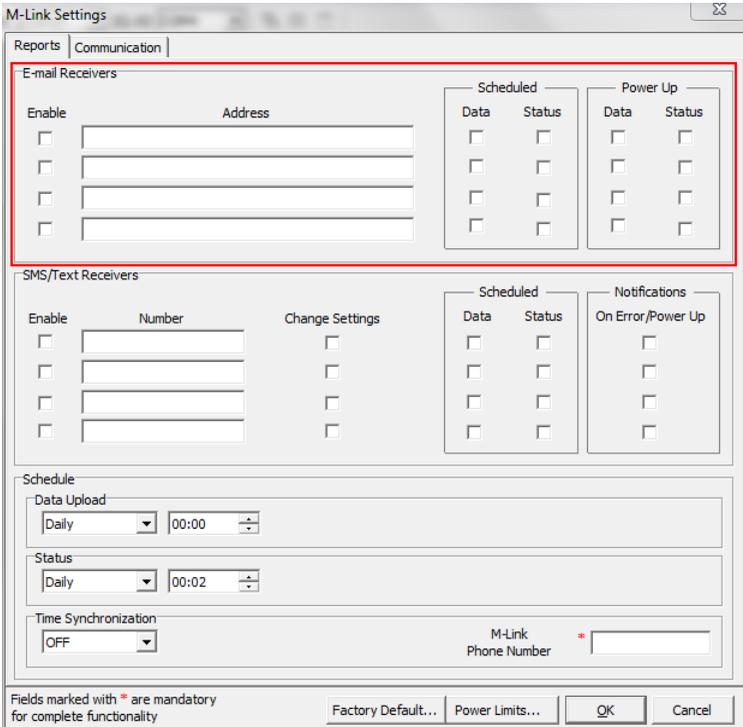
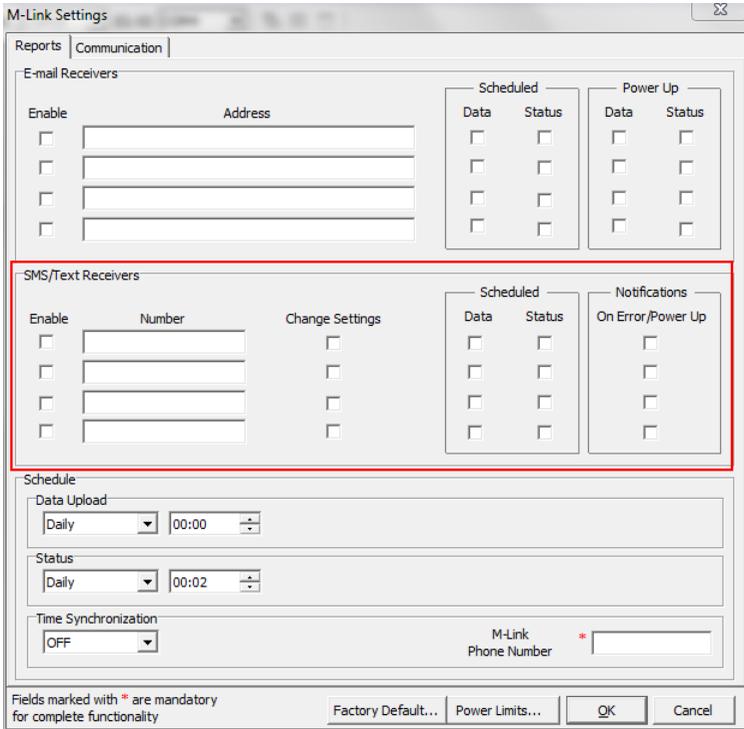


Figure 37. e-mail Settings

For each E-mail address desired to receive reports tick “Enable”, key in the E-mail address, and tick the type of report (scheduled status- or data reports, or reports on next power up).

Mobile / Cell Phone Settings

The following settings regarding mobile / cell phone have to be entered in order to receive text messages from the M-Link



The screenshot shows the 'M-Link Settings' dialog box with the 'Communication' tab selected. The 'SMS/Text Receivers' section is highlighted with a red border. It contains a table with columns for 'Enable', 'Number', 'Change Settings', 'Scheduled' (Data, Status), and 'Notifications' (On Error/Power Up). Below this is a 'Schedule' section with fields for 'Data Upload' (Daily, 00:00), 'Status' (Daily, 00:02), and 'Time Synchronization' (OFF). An 'M-Link Phone Number' field with a red asterisk is also present. At the bottom, there are buttons for 'Factory Default...', 'Power Limits...', 'OK', and 'Cancel', along with a note: 'Fields marked with * are mandatory for complete functionality'.

Figure 38. Mobile Phone Settings

For each phone desired to receive reports tick “Enable”, key in the international phone number, and tick the type of report (scheduled status- or data reports, or to give notifications on errors).

The “Change Settings” field allows the phone to send service instructions to M-Link.

Schedule

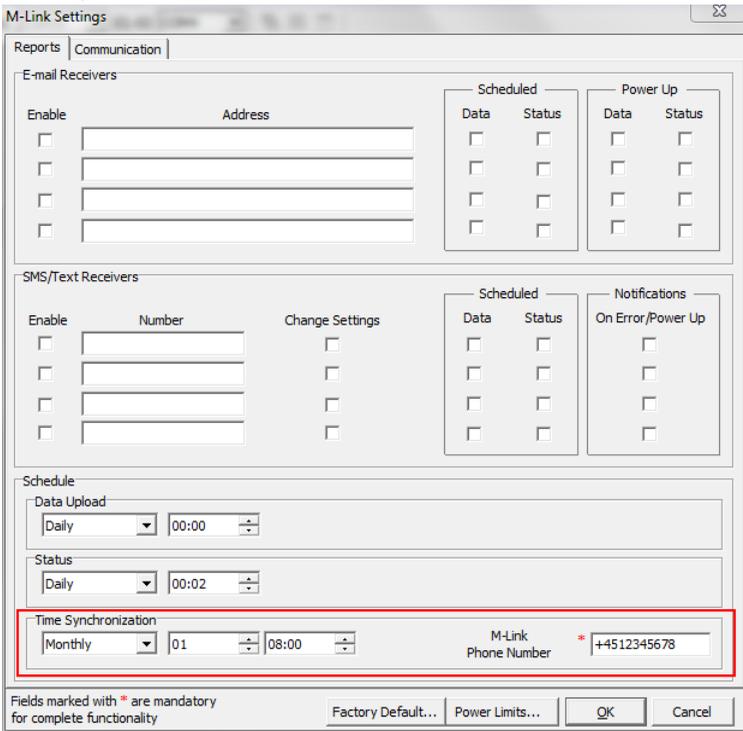
The report schedule can be set individually for data upload and for status upload in intervals from every 6 hours up monthly

Data Upload covers the e-mail with an attached datafile that contains the measurement data from the ICL-02i see page 84. If

SMS/Text messages are enabled, then an SMS notification is sent on each data upload.

Status covers an e-mail that informs about status on the previously sent data uploads. If SMS/Text messages are enabled, then an SMS is also sent with compressed information on the status.

Time Synchronization



The screenshot shows the 'M-Link Settings' dialog box with the 'Communication' tab selected. The 'Time Synchronization' section at the bottom is highlighted with a red border. It includes a dropdown menu set to 'Monthly', a field for '01' with increment/decrement arrows, a field for '08:00' with increment/decrement arrows, and a text field for 'M-Link Phone Number' containing '+4512345678'. The asterisk indicates this field is mandatory.

Figure 39. Time Synchronization Settings

The M-Link can be set to regularly synchronize the internal clock with the network time.

This requires that the phone number of the SIM card in the M-Links is entered.

The synchronization can be set to daily, weekly or monthly. The time will also be synchronized on a power up transmission.

Note:

Each Time sync. requires an SMS/text message which may be charged by the service provider.

Edit Settings

It is often useful to retrieve the settings stored in M-Link and use this as a template for programming the new settings.

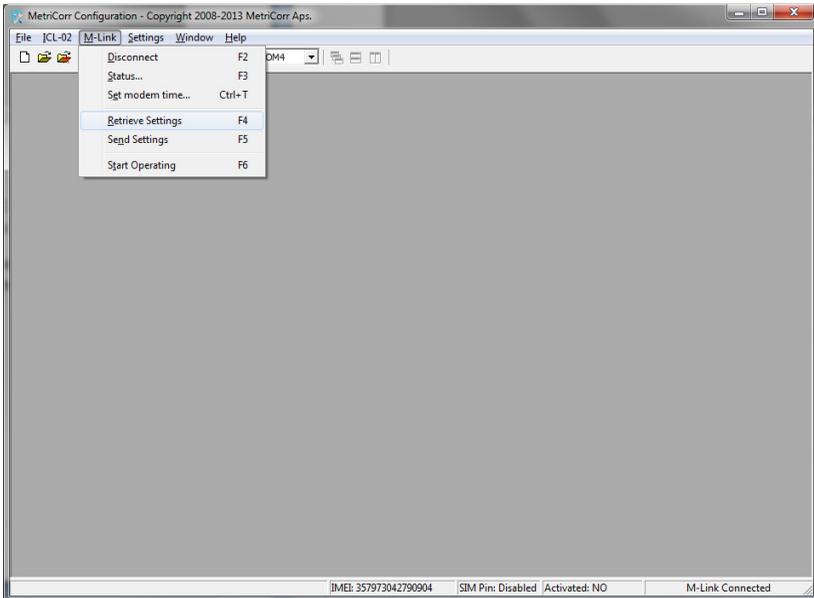
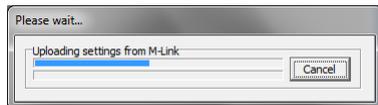


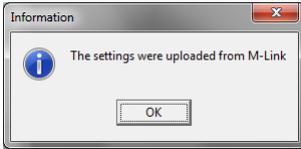
Figure 40. Retrieve Settings from M-Link

In the M-Link menu choose Retrieve Settings.....

A status progress bar will be shown:



...Followed by the information that the settings have been retrieved



You can now use the retrieved settings as a template for the next settings – see the following paragraphs.

Use of Configuration Templates

Settings can also be programmed by opening a configuration template already saved on the PC.

In the File menu choose Open

...M-Link Settings...

From the separate window that will open choose the file (type .rmds) you wish to use as your template.

Note:

Templates are generated by keying in a configuration (M-Link settings, Time schedules etc.) as shown in the following sections and saving these settings as a .rmds file.

Send Settings to M-Link

Having followed the previous sections, the settings are now ready to be sent to the M-Link.

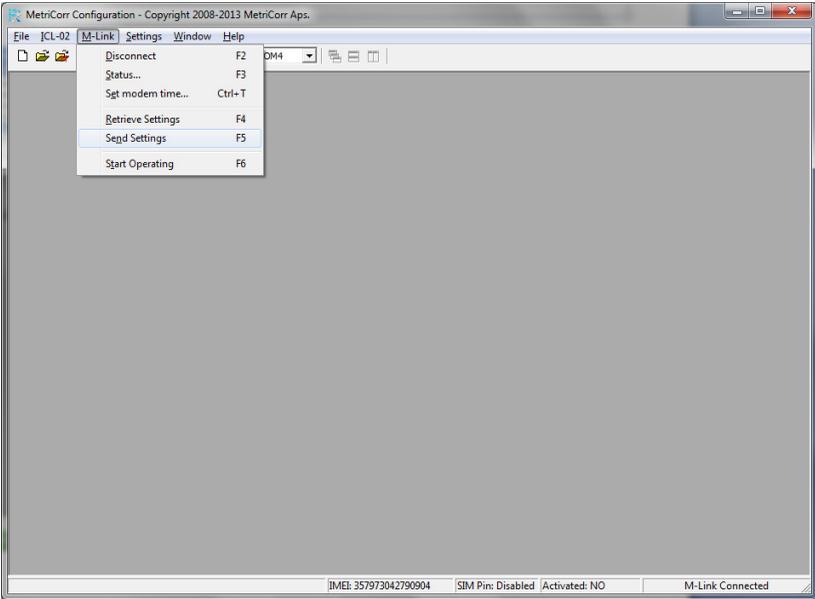
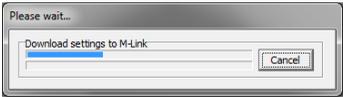


Figure 41. Send Settings to M-Link

Select M-Link Send Settings (F5)

...a progress bar will appear:



...followed by a confirmation message:



Settings have now been transferred to the M-Link which now just needs to be activated (see next section).

Activating M-Link

To activate (Start Operation of) the M-Link, do the following:

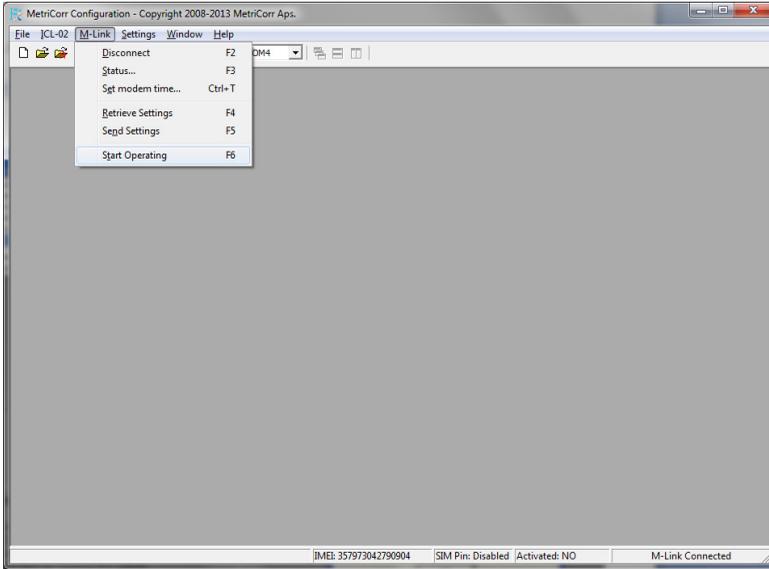
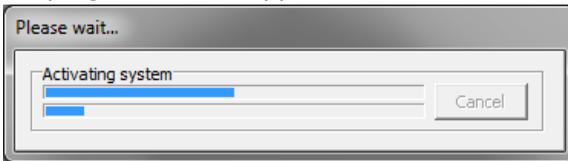


Figure 42. Activating M-Link

...a progress bar will appear:



...followed by a M-Link Status Message:

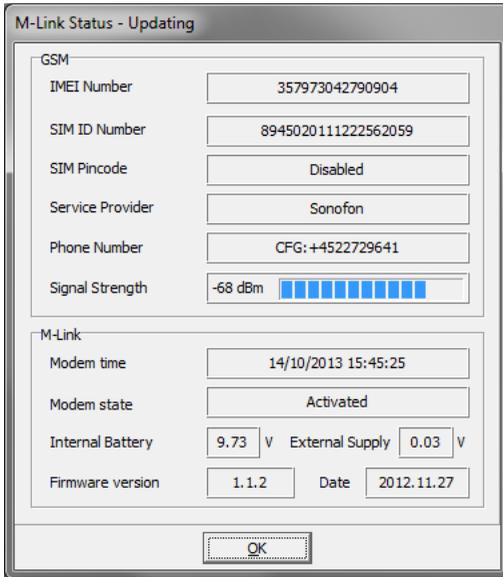


Figure 43. M-Link Status

Note:

When M-Link is activated, the “Start Operation” menu in the M-Links menu will turn into a “Stop Operation” menu. Stop the M-Link by clicking this option.

The M-Link is now activated. You can connect it directly to a programmed ICL-02i logger via “M-Link to ICL-02i cable” (#100326) and apply power to the ICL-02i.

M-Link will now start transmitting reports as scheduled.

Having programmed and activated the M-Link, you can print your final configuration from the File – Print menu – and the settings can be stored on the PC from the File – Save menu.

Receiving Data

Receive Text Messages on the Cell / Mobile Phone

If you have chosen to receive text message on your mobile / cell phone the messages can be of the following three types:

DATA

Upload: <ICL-02 –SerialNo> <number of uploaded readings>

Rsp: <Queue number identification from server>

STATUS

Status: <ICL-02 –SerialNo> Unread: <Number of unread reading>

Total: <Total number of readings in logger>

Rsp: <Queue number identification from server>

ERROR

Error (<Error code>): <Message>

The message informs about conditions that differ from a normal data transmission and that may have caused an irregular or missing data transmission.

Error messages will be registered in the Event Log and will be displayed in the next transmitted e-mail Status message - see Figure 44 (7).

In the case of receiving error messages, the following actions should be taken:

1. If you receive the error message in a session where you have previously received messages without problems – your settings are most probably correct and the single attempt failed due to Service Provider drop out:
 - a. Await next upload.
 - b. Check battery.

2. If you receive the error message in a session where you have not previously received messages: Double check the settings of the
 - a. M-Link settings.
 - b. e-mail settings
 - c. SMS settings
 - d. Schedules
 - e. Battery or external power.

Receive e-mail Status

If M-Link is set to send e-mail status messages the message will appear as follows:

Message (HTML)

From: data-produktionstest_790920@metricorr.dk
 To: Remote Upload
 Cc: M-Link Status AKI0350201
 Subject: M-Link Status AKI0350201
 Sent: Wed 09/10/2013 13:27

Status Information		Cause of Transmission		Power Up	
Modem	M-Link IMEI: 357973042790920	FW Vers.	1.1.2	FW Date	2012.11.27
Logger	CL-02i/80 Serial No. AKI0350201	FW Vers.	4.3.1T0	FW Date	Oct 3 2013

Probe		# 1	# 2
Type		T-037-04	T-037-04
Serial No.		T-037-04P1	T-037-04P2
Tag			
Description			

Readings in Memory	
Total	1116
New	2
Free	78885
Next Reading Starts 2013/10/9, 13:26	

Upload Log											
Time	Status	Reading	Vint	Vint	Vext	Vext	Temp.	Temp	Server greeting	Server response	
Begin	End		@boot	@end	@boot	@end	@boot	@end			
13/10/09,13:06:08	13/10/09,13:06:59	0	49	10.48	10.47	12.08	12.04	26.0	31.0	ufs.cybercity.dk ESMTP Postfix	queued as 4CEE63F420

Event Log		
Time	Code	Message

MetriCorr M-Link System automatically generates this e-mail

If you have problems receiving and/or processing this file, please report to remote-monitoring@metricorr.dk

MetriCorr ApS

Figure 44. Status e-mail received from M-Link

Fields in Status e-mail - Figure 44

1. Cause of transmission is normally *Scheduled* or *Power Up* and relates to *E-mail Settings* see page 72
2. The IMEI number and the firmware version of the M-Link
3. The Serial Number, and firmware version of the ICL-02 logger
4. Probe information as keyed in during programming the ICL-02 logger
5. Information about the number of measurements in the logger and the time when the next measurement is planned
6. The Upload Log informs about key parameters from the previous 5 Data Uploads. The parameters are:
 - a. Begin and end time of the transmission.
 - b. Status on the transmission – normally = 0
 - c. Reading tells the number of uploaded measurements from the ICL
 - d. M-Link internal battery voltage - Vint.
 - i. @boot (before transmission)
 - ii. @end (after transmission)
 - e. M-Link external power voltage - Vext.
 - i. @boot (before transmission)
 - ii. @end (after transmission)
 - f. M-Link internal temperature - Temp.
 - i. @boot (before transmission)
 - ii. @end (after transmission)
 - g. Server greeting & Server response to trace data at the service provider
7. Event Log includes all events since the previous Status e-mail. Events has a time stamp from M-Link. Events can be:
 - a. Expected events such as Time adjusting
 - b. Power supply weak detection on ICL or M-Link
 - c. Error in communication between M-link and ICL
 - d. Internal errors in M-Link
 - e. Errors in the GSM or GPRS network

Receive e-mail Data Upload

If you have chosen to receive E-mail Data Upload messages the message will appear as follows

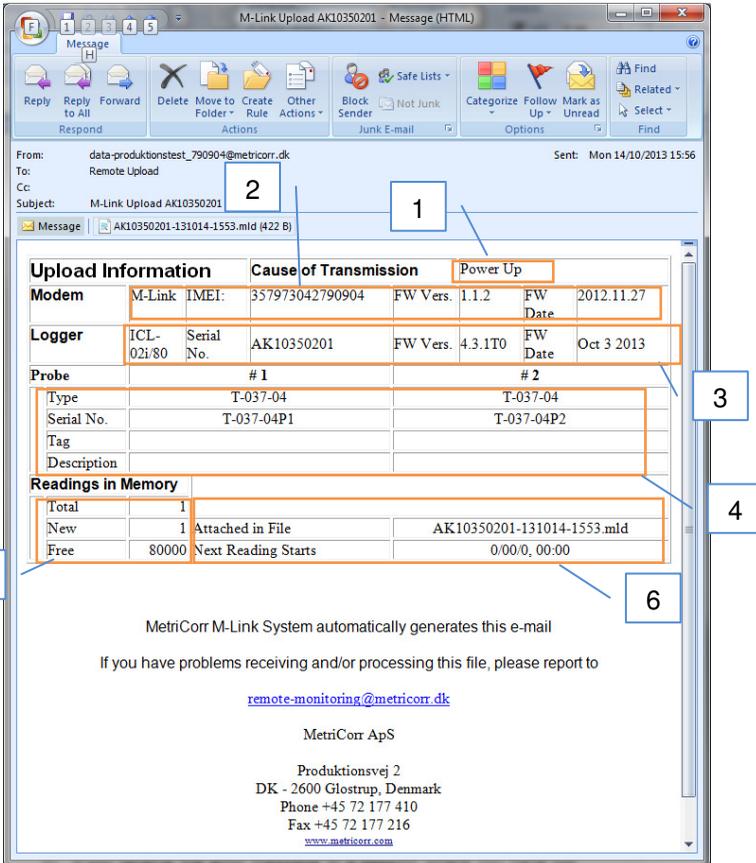


Figure 45. Data Upload e-mail received from M-Link

Fields in Data Upload e-mails - Figure 45

1. Cause of transmission is normally *Scheduled* or *Power Up* and relates to *E-mail Settings* see page 72
2. The IMEI number and firmware version of the M-Link
3. The Serial Number, and firmware version of the ICL-02 logger
4. Probe information as keyed in during programming the ICL-02 logger
5. The number of new measurements in the logger is normally the same as the number in the attached file. The total number includes the measurements that are already uploaded.
6. The name of the attached data file and the time when the next ICL measurement is planned to start

Handling Data

The data files are e-mailed as attached type .mld files.

These data can be viewed and analyzed in several ways:

Data View with M-Config

The attached .mld file can be opened with M-Config and viewed.

In order to make the file available as .acd file perform the following steps:

- 1) Save the attached mld. file on your PC (right click – Save As...)
- 2) ..for instance in the folder

C:\Program Files\MetriCorr\M-Config\MLD

which has been created when the program was installed.

- 3) From the M-Config program open the saved .mld file. The moment this file is opened it transforms into .acd files (one

file per probe being monitored). These files appear in separate windows in the M-Config program.

- 4) Each of the generated .acd files are saved by clicking File..Save ACD-File as..
- 5) From this point on, the created .acd files can be treated as usual .acd files, i.e. open and treated in excel templates etc.

When the .mld files are opened with M-Config, then the data can be managed and saved as described in the ICL-02i section see page 34

Data Analysis with M-Report

M-Report software from MetriCorr can be used to further analyze.

M-Report can import data from the file formats .acd and .mld. The .mld files can also be imported directly from the e-mail server. See the M-Report user manual, 100470, for further details.

M-Link Power Requirements

The M-Link runs from 6 x AA internal batteries (9V) or from an external 12V DC supply. In order to protect the batteries from fully discharging and leaking, M-Link checks the supply voltages, and sends an SMS/text message when the warning limit is reached. At the close limit the transmissions are stopped. OFF limit is to determine if a power source is connected. If both sources are connected, then the external limits apply.

To see the limits then Select the Setting *M-Link* menu..and select *Reports*. Tab, and press *Power Limits* button:

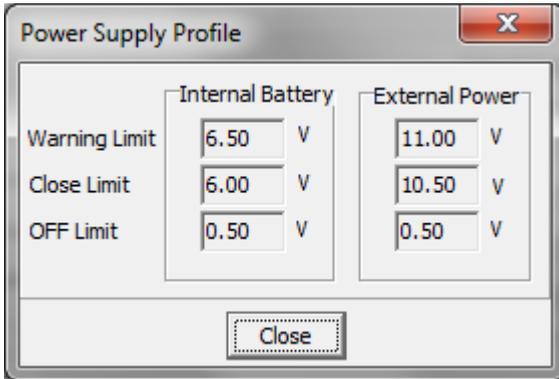


Figure 46. M-Link Power Limits

Standby consumption: @12V (external supply), I_{stby} = 0.15mA
 @9V (Internal supply), I_{stby} = 0.17mA

The power consumption required for each transmission depends on many parameters. The network coverage determines how much transmission power is needed, and the availability determines the time to establish the GPRS connection. Of course the amount of measurement data will also affect the transmission time. The following estimates are based on laboratory and field experience in Denmark (56°N, 11°E).

Weekly Transmissions

Weekly transmissions data will typically range from 168 measurements (1 hour interval) to 1008 measurements (10min interval). 1008 measurements are used for the estimate.

The average current consumption @12V during a full transmission including Wake up, initializing and transmission is an average current 26mA in 6 minutes.

@12V: 26 mA for 360 s requiring 2.6 mAh per transmission

@9V: 35 mA for 360 s requiring 3.5 mAh per transmission

Daily Transmissions

If daily transmissions are chosen, data will typically range from 24 measurements (1 hour interval) to 144 measurements (10 min. interval). 144 measurements are used for the estimate.

@12V: 21 mA for 300 s requiring 1.8 mAh per transmission

@9V: 29 mA for 300 s requiring 2.5 mAh per transmission

Internal Battery Supply

Internal batteries 6 x 1,5V AA batteries, Capacity approx. 3000mAh @9V

In this example is assumed that approx. half of the capacity can be utilized, say 1500mAh.

Idle mode Consumption	0.17 mA	X	8760 h	1489 mAh
Transmission consumption	3.5 mAh	X	52	182 mAh
Total				1671 mAh

Table 4. Transmitting 1008 measurements once a week in 365 Days (1 year)

Idle mode Consumption	0.17 mA	X	5856 h	996 mAh
Transmission consumption	2.5 mAh	X	244	610 mAh
Total				1606 mAh

Table 5. Transmitting 144 measurements once a day in 244 days (8 months)

Daily transmissions will reduce the expected internal battery lifetime from almost a year and down to 8 months.

External Power Supply

The external power is assumed to be 12V

Idle mode Consumption	0.15 mA	X	8760 h	1314 mAh
Transmission consumption	2.6 mAh	X	52	135 mAh
Total				1449 mAh

Table 6. Transmitting 1008 measurements once a week in 365 Days

Idle mode Consumption	0.15 mA	X	8760 h	1314 mAh
Transmission consumption	1.8 mAh	X	366	659 mAh
Total				1973 mAh

Table 7. Transmitting 144 measurements once a day in 365 days

Regulatory and Type Approval Information

CE Conformity

The M-Link Terminal meets the requirements of the EU directives listed below:

- R&TTE Directive 1999/5/EC
- LVD 2006/95/EC
- RoHS Directive 2002/95/EC

Compliance with FCC Rules and Regulations

The M-Link Terminal contains FCC ID QIPTC65I

FCC Section 15.105 (b)

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receivers connected.

- Consult the dealer or an experienced radio/TV technician for help.

Compliance with IC Rules and Regulations

The M-Link Terminal contains IC 7830A-TC65I

Standards of the Ministry of Information Industry of the People's Republic of China

SJ/T 11363-2006 "Requirements for Concentration Limits for Certain Hazardous Substances in Electronic Information Products" (2006-06).

SJ/T 11364-2006 "Marking for Control of Pollution Caused by Electronic Information Products" (2006-06).

According to the "Chinese Administration on the Control of Pollution caused by Electronic Information Products" (ACPEIP) the EPUP, i.e., Environmental Protection Use Period, of this product is 20 years as per the symbol shown here, unless otherwise marked. The EPUP is valid only as long as the product is operated within the operating limits described in the Cinterion Wireless Modules Hardware Interface Description.

Please see Table below for an overview of toxic or hazardous substances or elements that might be contained in product parts in concentrations above the limits defined by SJ/T 11363-2006.



部件名称 Name of the part	有毒有害物质或元素 Hazardous substances					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
金属部件 (Metal Parts)	○	○	○	○	○	○
电路模块 (Circuit Modules)	X	○	○	○	○	○
电缆及电缆组件 (Cables and Cable Assemblies)	○	○	○	○	○	○
塑料和聚合物部件 (Plastic and Polymeric parts)	○	○	○	○	○	○

O:
表示该有毒有害物质在该部件所有均质材料中的含量均在SJ/T11363-2006 标准规定的限量要求以下。
Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in SJ/T11363-2006.

X:
表示该有毒有害物质至少在该部件的某一均质材料中的含量超出SJ/T11363-2006标准规定的限量要求。
Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part *might exceed* the limit requirement in SJ/T11363-2006.