

COMET XPS-60 / COMET XRS-60

OPTICAL READING MODULE

INSTALLATION MANUAL



Revision History

Index	Date	Responsible	Changes
a	June 2007	C. Wieland	First official issue.

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1 General Document Information

Safety

Please read chapter 3 **Safety** carefully before carrying out any work on the Comet XPS-60 or XRS-60 modules.

Document Validity

This document is valid for installation of the Comet XPS-60 and XRS-60 modules, and is intended for use by personnel carrying out this work.

Proprietary Information

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2 Abbreviations and Terminology

Term	Comments
ESD	Electrostatic Discharge: ESD is a discharge of electrical current between two object which are at different potentials, which is generally caused by friction. Discharges can be avoided by ensuring that the two objects are at the same potential by means of e.g. grounded wrist straps.
OCR	Optical Character Recognition: A procedure for recognising characters optically based on their optical characteristics. Comet optical reading modules use an innovative “retina-inspired” OCR procedure which has inherently high recognition reliability.
ROI	Region of Interest: Regions defined for optical character recognition in the Comet reading module. These regions are set up individually to take account of the register requirements on the meter which is to be read.

3 Safety



Read this section carefully before proceeding with any work on the COMET XPS-60 or COMET XRS-60. This chapter is intended for your safety and the safety of your customers.

General

Before installing or using the Comet XPS-60 or XRS-60 optical reading module, read the manual completely, and make sure that you understand it fully. Check that your application does not exceed the safe operating specifications for this unit.

Electrostatic Discharges

To prevent electrostatic charges building up on the Comet XPS-60 optical reading module:

- Do not rub the housing with a dry cloth or any other materials.
- Do not install in an environment where gas can flow around the unit, as this could potentially build up an electrostatic charge on the housing.

Electrical Transients

Make sure that during installation and operation of the Comet XPS-60 optical reading module the device is not exposed to hazardous transients. This is avoided by connecting the module to protected, potential-free auxiliary units (e.g. laptop computers, handheld devices) only. Refer to the technical specifications section for an exact description of the external connections.

Hazardous Areas

When the Comet XPS-60 or XRS-60 optical reading module is installed in a hazardous zone, its cable is not permitted to go outside this zone under any circumstances.

External Connections

The connection specifications must be fulfilled (see chapter 7), and any device connected to the Comet XPS-60 or XRS-60 must be an associated apparatus according to EN50020.

Housing

- The Comet optical reading module is sealed and it is not permitted to open the housing in a hazardous area.
- The module contains no user-serviceable parts, and should also not be opened in a safe area.

Battery Replacement

Batteries cannot be replaced by the user. Never attempt to open the module, even in a safe area.

Cleaning

- Do not use solvents for cleaning the Comet XPS-60 or XRS-60 optical reading module. This can damage the module and prevent it meeting safety and technical requirements.
- To clean the unit, remove it from the hazardous area and use a soft, damp cloth. Never clean the unit in a hazardous area!

Before Installation, Maintenance or Modification Work

Prevent damage to internal electronics from electrostatic discharges (ESD) by discharging your body to a grounding point (e.g. use of wrist strap).

Battery Disposal

- The batteries used in Comet XPS-60 and XRS-60 optical reading modules may present a risk of fire or chemical burns if not handled correctly. Do not attempt to recharge, disassemble, heat above 100°C, or incinerate.
- Dispose of used batteries promptly. Keep away from children. Do not disassemble and do not dispose of by incineration.
- All European countries regulate the disposal or recycling of batteries. The user is responsible for proper disposal of the batteries. The European Community (EC) has issued two directives, 91/157/EEC and 93/86/EEC. Each member country of the EC implements these directives independently and in different ways.

4 Product Information

4.1 General

Comet XPS-60 and XRS-60 optical reading modules are universal interface devices for utility meters that provide optically-based meter register data capture. The units feature an R5 pulse output and a serial RS232 interface for programming/parameter setting (see chapter 5 of this document), and connection to third-party data loggers, PC's etc.

Comet XPS-60 and XRS-60 optical reading modules operate on the principle of reading the current register value, rather than accumulating increments of consumption (as done by traditional pulse-operated solutions). This solution incorporates an inherent auto-correction capability, since no cumulative errors are being processed and stored in the device.

Comet XPS-60 and XRS-60 optical reading modules require no modifications to attach to currently installed meters, and are therefore an ideal, cost-effective means of upgrading such devices to smart meters. This constitutes an innovative approach to integrating smart metering and AMR functionality into existing meters in the field.

The basic differences between the two device types are as follows:

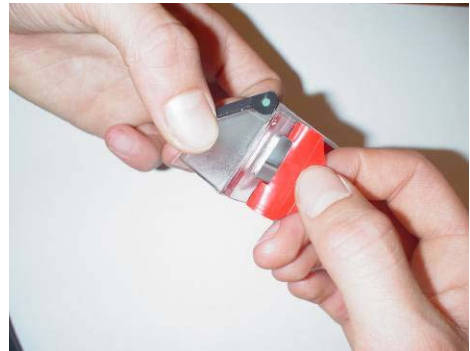
- **Comet XPS-60:** This device has a pulse output and a serial interface.
- **Comet XRS-60:** This device has a pulse output, a serial interface and an additional low power radio interface.

5 Installation and Parameter Setting

5.1 Mechanical Installation

This chapter covers the mechanical attachment of the module to gas, electricity and water meters.

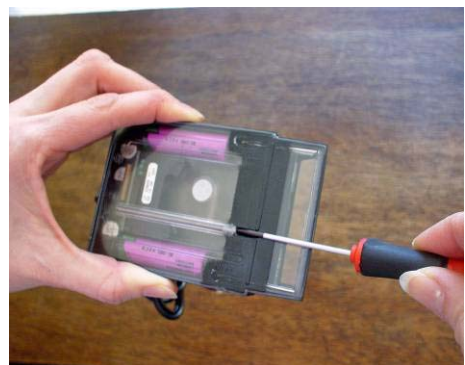
1. Before mounting the plastic bracket on the meter register, make sure that the surface around the register is clean and dry.
2. Remove the protective film from the plastic bracket

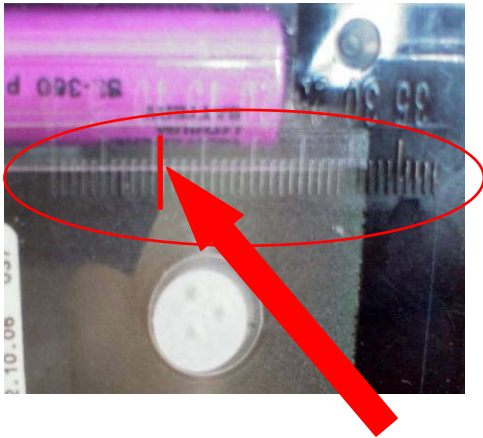


3. Stick the plastic bracket onto the meter, as shown in the photograph.

Make sure that the bracket is horizontal and that its indentation is correctly centred on the meter register.

4. Before adjusting the plastic casting which carries the optical components, you need to estimate the distance between the surface of the digits to be read and the outer face of the rear optical window of the Comet module. This distance should never be less than 5 mm.





Front surface of plastic casting carrying optical components

5. When you know the distance ($\pm 3\text{mm}$), set the front face of the plastic casting carrying the optical components to align with the graduation on the scale that corresponds to the estimated distance.

The elevating screw can be driven by a precision screwdriver (e.g Lux-Tools Part No. 58 5740, PH00 x 60 mm; Part No. 58 5730, 1.5 x 60 mm)

6. Insert the COMET module into the plastic bracket as shown in the photograph.



7. Secure the module by inserting the sealable red locking strap provided for this purpose.

Mechanical installation is now complete and you can proceed to setting the parameters for the module.

5.2 Parameter Setting and Adjustment

5.2.1 Connection to the Computer

This topic explains how to connect your computer to the Comet module.

1. First ensure that the Comet XPS-60 / XRS-60 Demo software is installed on your laptop computer, which must use the operating system Windows 2000 or Windows XP.
2. Connect the RS232 port of your computer to the RJ12 socket of the Comet module via an appropriate isolation barrier, if required. It is also possible to make the connection using a USB port on the computer with a corresponding USB to serial adapter.

Note on using a USB port

To use a USB to serial adapter for connecting to the Comet XPS-60 or Comet XRS-60, you first need to load the driver for the adapter according to instructions provided by its manufacturer.

Plug in the USB to serial adapter, which will then be recognised by Windows and added to the list of COM and LPT connections in the Windows Device Manager.

5.2.2 Basic Configuration Comet XPS-60 and XRS-60

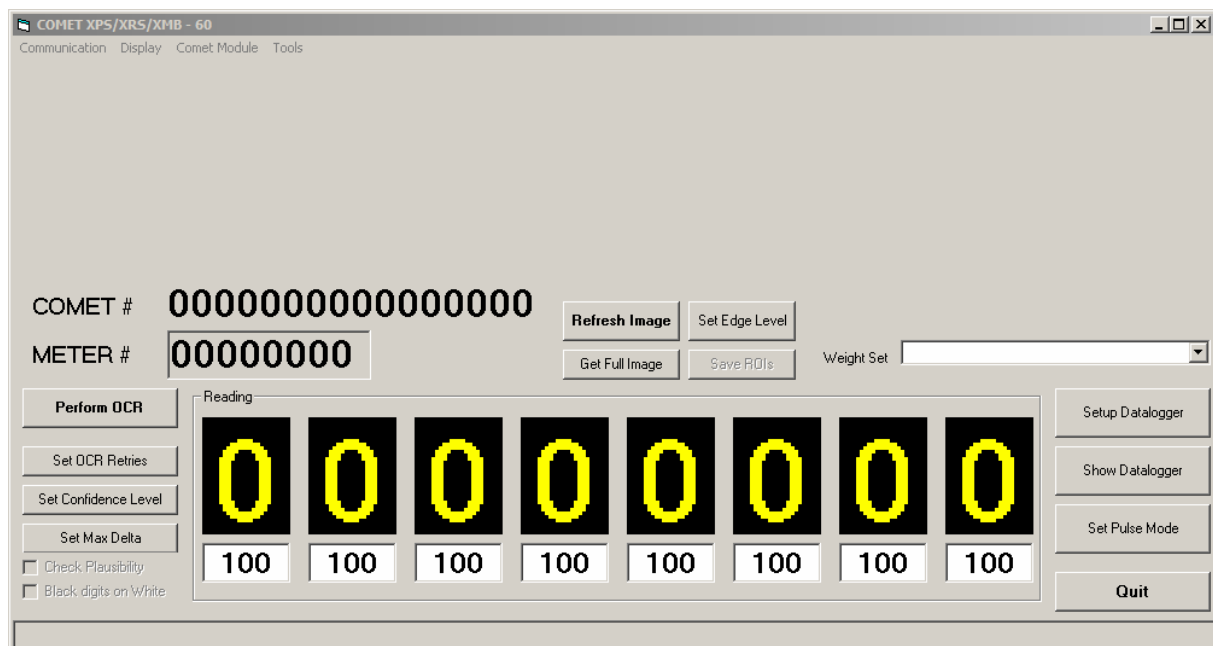
Timing in the computer and Comet device

First of all, ensure that the time in your computer is correct, since it will be downloaded to the Comet device when setting the data logger.

Start the **Demo** configuration software by double-clicking on its icon and follow the procedure described below.

The startup screen for the Demo software is shown in the following screenshot. Initially, the various fields are empty or are filled with 0's.

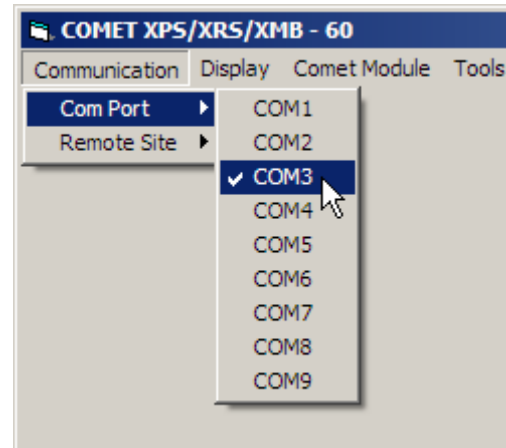
At the top of the window is the menu bar, which is used to select the different functions during installation.



Demo startup screen

1. Open the **Communication** menu. Select **Com Port** in this menu and then click on the Com Port to which the Comet device has been connected. This is either the direct address of the serial port or the assigned address of a USB to serial adapter.

If an incorrect Com Port is selected, it is not possible to communicate with the Comet device.



Com Port Selection

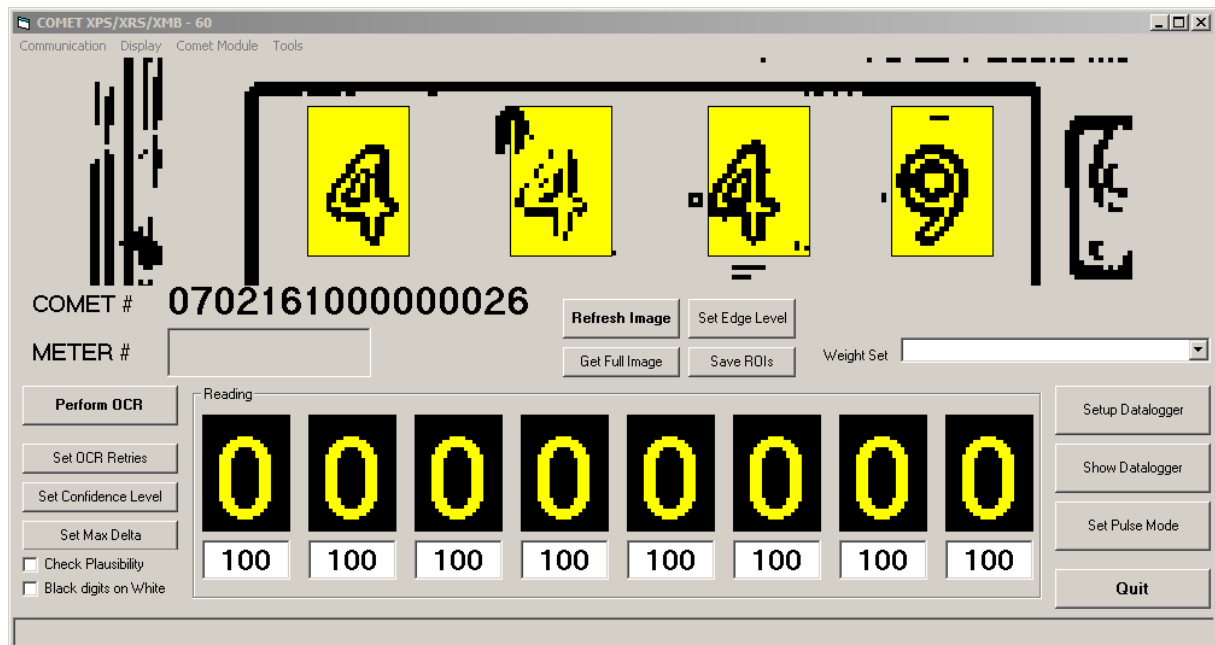
The menu item **Remote Site** is intended for connecting to a remote XPS-60 interfaced with a GSM or PSTN modem. This feature is not implemented in this version of the Demo software.

2. Click **Get Full Image** to retrieve the full register area seen by the Comet module. This procedure takes several seconds and returns the image in the top part of the window. This image includes the already defined Regions of Interest (ROI's) from the module, which are shaded yellow. At this stage, the ROI's will probably not be fully aligned to digits to be read, and there may even be an incorrect number of ROI's. This is treated in step 4 below.

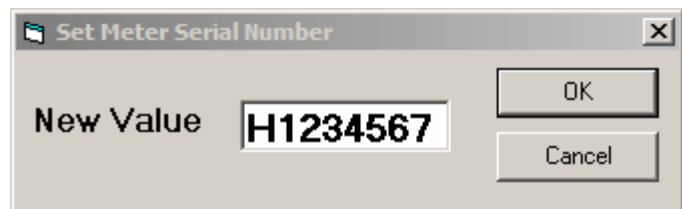
During this operation, the serial number of the Comet device is also automatically retrieved and inserted in the field **COMET #**.

The screen will now appear similar to the one shown below.

Screen after Get Full Image command



3. Double-click on the **METER #** field. This opens a pop-up window for entry of the meter property number.



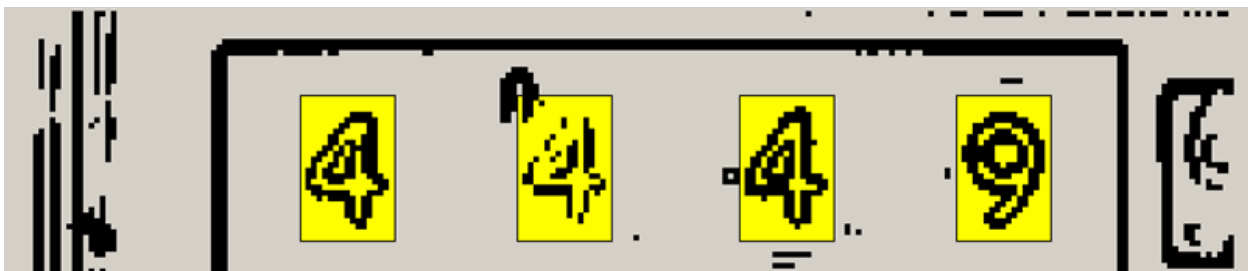
Enter the property number, which can contain up to 8 alphanumeric characters, and click **OK**.

4. Most modern meters have white digits on a black background, which is the default in the **Demo** program. If your meter has black digits on a white background, set this by setting the checkbox **Black Digits on White**, and click again on **Get Full Image**. This is important for the Optical Character Recognition (OCR).

5. It is now time to set the ROI's.

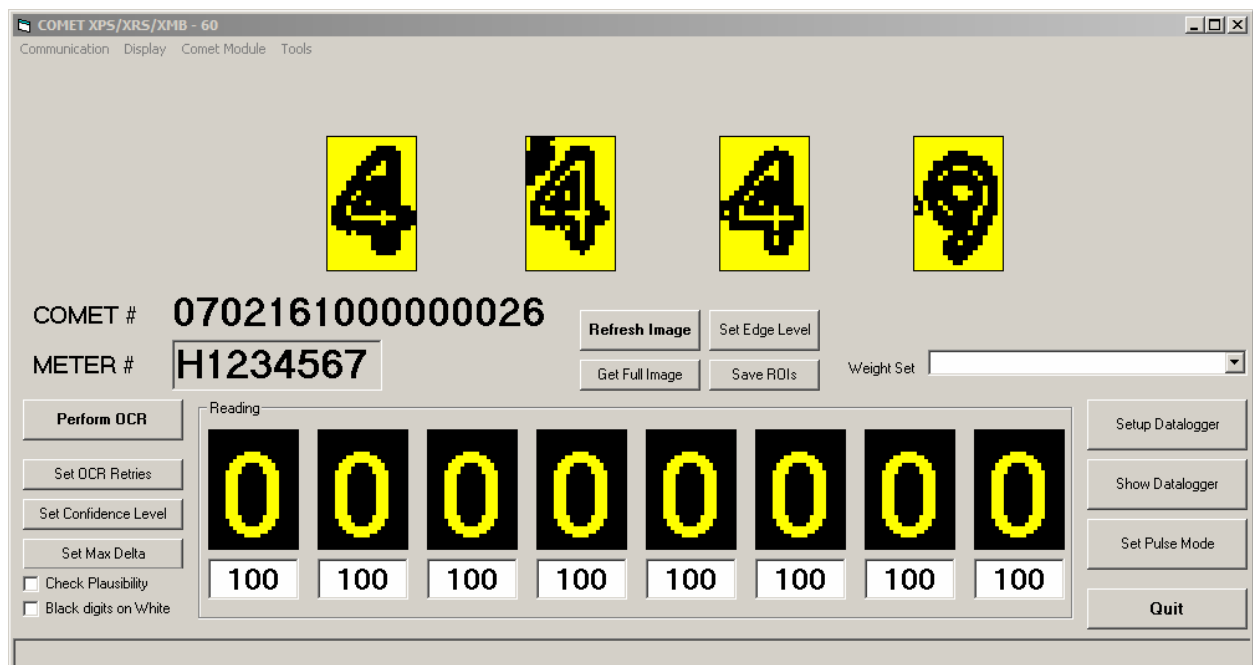
- The image obtained in step 2 may not contain the correct number of ROI's for your application; if this is the case, you can add or delete ROI's by right-clicking on one of the outer existing ROI's and selecting either **Add ROI** or **Remove ROI**.
- Move the boxes until they contain the register digits which are to be included in the Optical Character Recognition (OCR). This is an iterative process, with the following sequences:
 - Left and right movement is made individually for each ROI by holding down the left mouse button on the ROI and then moving it left or right.
 - Width adjustment applies to all ROI's simultaneously. Hold down the left mouse button on the right-hand border of an ROI and move it left or right. The final width should be about 1 pixel wider than the digits **on each side**.
 - Up and down movement moves all ROI's simultaneously. Hold down the left mouse button on one of the existing ROI's and drag it up or down. The top of the box should be about 2 pixels (screen lines) above the digits.
 - Height adjustment applies to all ROI's simultaneously. Hold down the left mouse button on the bottom border of an ROI and move it up or down. The final height should be about 2 pixels above and below the digits.
- Repeat the above steps until you are satisfied with the result.
When finished, the appearance of the upper part of the window should be similar to the screenshot shown below.

Screenshot after setting the ROI's



6. Save the ROI settings to the Comet device by clicking on **Save ROI's**. This sends the current settings to the Comet device, where they are used for future register readings.
7. Remove the extraneous "noise" from the image by clicking on **Refresh Image**. This retrieves the image from the Comet device for the ROI's only, removing all other unnecessary parts.

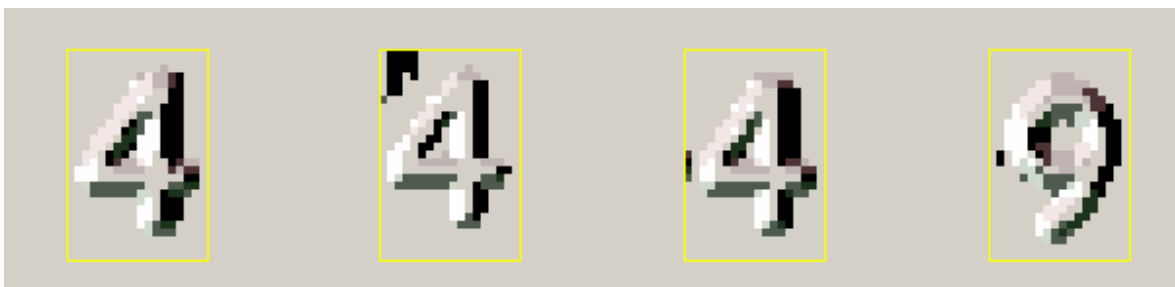
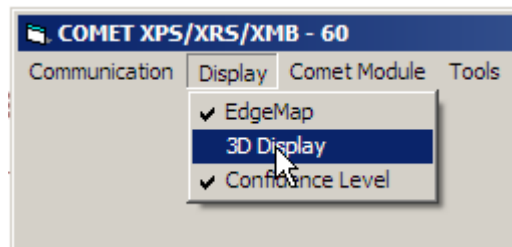
Screenshot after using Refresh Image



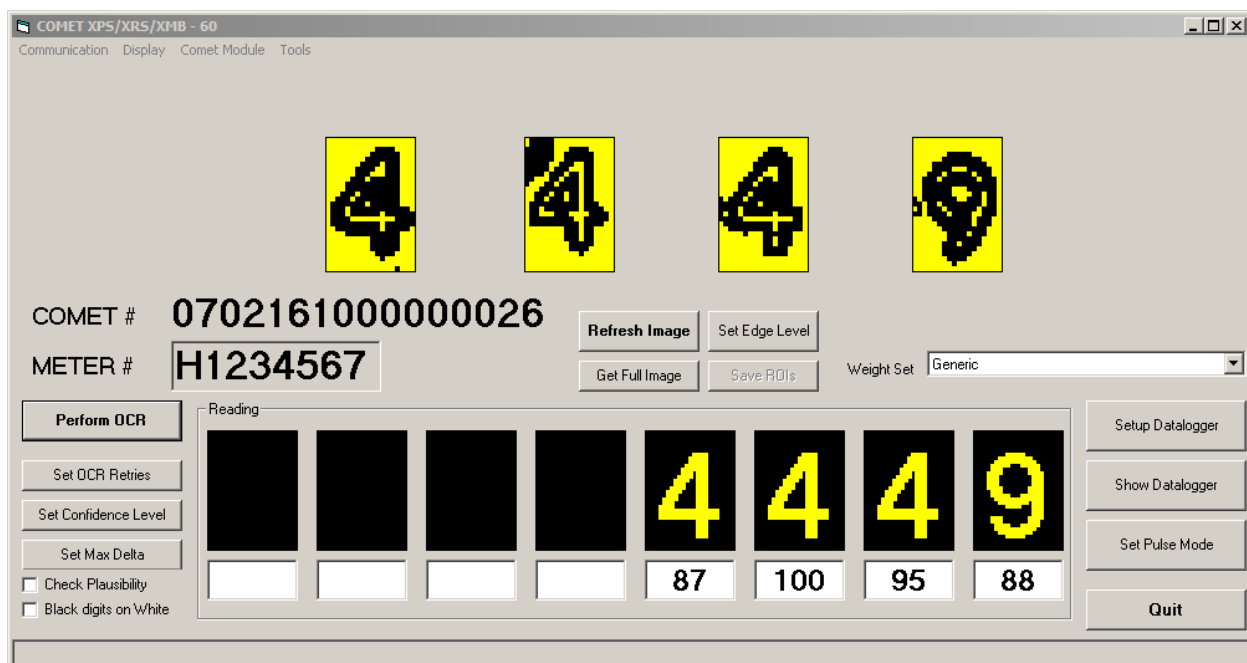
8. Open the pull-down menu **Weight Set** and select **Generic**, unless Xemtec has advised you to use a different setting. **Generic** is a setting which functions correctly for most meters. If you have any problems with OCR in later steps, or doubts about this setting, contact Xemtec to obtain detailed information and assistance.

9. The display mode for the ROI's can be changed to 3D mode by opening the **Display** menu and clicking on **3D Display**.

The effect obtained can be seen in the following screenshot.



10. The basic setup for OCR is now complete, and you can check how successful it is by clicking on **Perform OCR**. A typical screenshot is shown below.



Screenshot after Perform OCR command (Set Edge Level = 80)

Note that the four characters recognised by the OCR have a value in the boxes below them (in this case, 87, 100, 95, 88). This shows the amount of confidence which can be placed in them. Basically, any value above 45 is good, showing excellent confidence that the recognised number is correct.

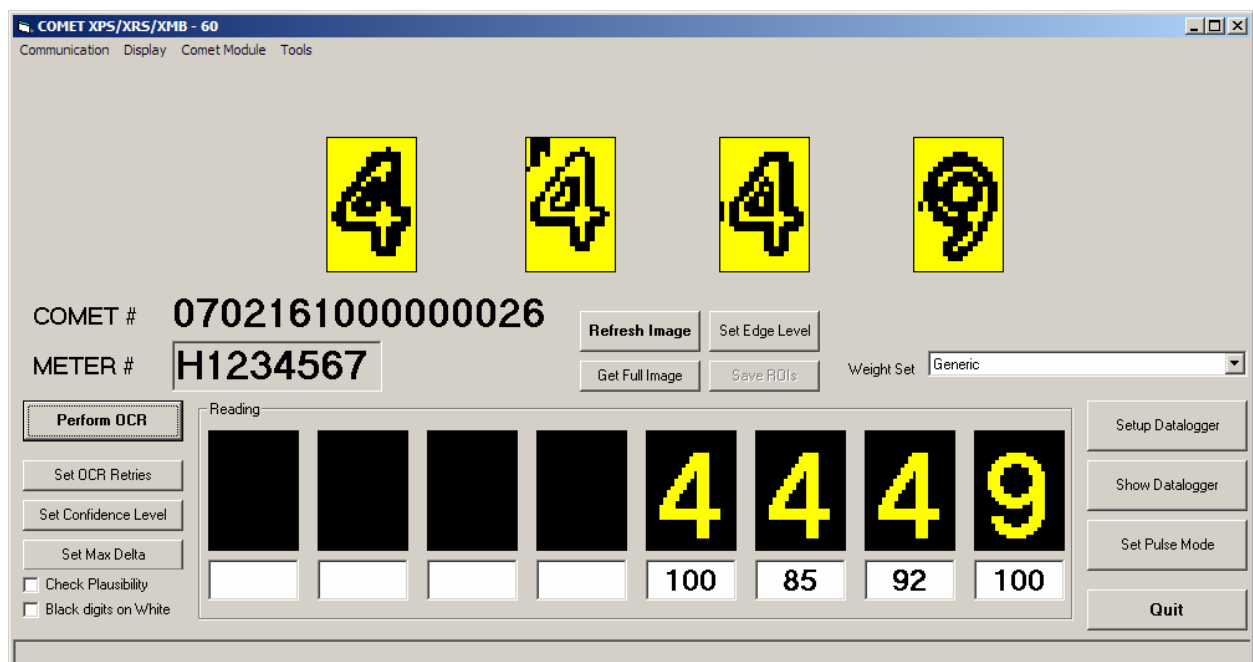
11. If the OCR performance was not good, it is possible that one or more of the following parameters requires adjustment:

- **Set Edge Level:** This parameter changes the contrast for the black/white transitions in the ROI's. It should normally be set between 70 and 85. After making a change, click **Refresh Image** and try **Perform OCR** again.

This parameter is usually only important for registers where the distance to the Comet module is between 2-4 cm.

The screenshot in step 10 above was made with **Set Edge Level = 80**. The one shown below is after changing **Set Edge Level** from **80** to **70**.

Screenshot after Perform OCR command (Set Edge Level = 70)

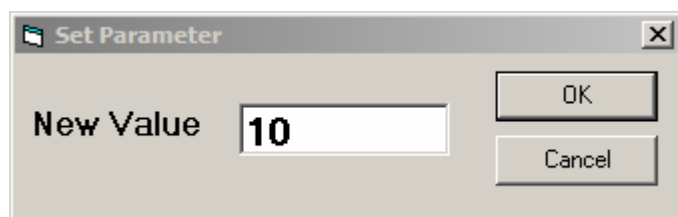


With a setting of 70, the contrast has been reduced. You can see that the confidence level has increased for the 1st and 4th digits, but has decreased for the 2nd and 3rd digits. All of these values are excellent, due to the robustness of the OCR used in the Comet devices. Any value above 45 for the confidence level is good.

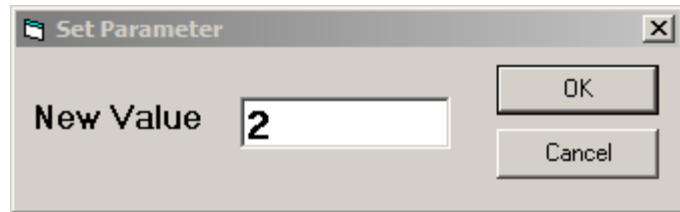
- **Weight Set:** This is a set of parameters which determines the way in which the OCR interprets the edges of the digits. If there is a poor result for the OCR, it is possible that an incorrect **Weight Set** has been selected. Open the pull-down menu **Weight Set** and select **Generic**, unless Xemtec has advised you to use a different setting. **Generic** is a setting which functions correctly for most meters. If you have any problems with OCR in later steps, or doubts about this setting, contact Xemtec to obtain detailed information and assistance.

12. **Set Confidence Level:** This parameter sets the minimum confidence level for values interpreted by OCR in the Comet module. This value is normally set at 45, which is recommended by Xemtec based on a great deal of experience, but may be set higher if desired.
13. If you wish to use plausibility functionality, set the **Check Plausibility** checkbox. This checks whether the consumption value received for the previous hour is above a set limit.

Click on **Set Max Delta**. You are asked to enter a limit for the maximum change in the last digit of the received register value during a 1-hour period (e.g. max. m³/h, ft³/h or kWh/h) . If this value is exceeded, it is rejected as implausible (register value is taken as == ==).



14. If the OCR attempts to make a reading during a digit change in the register, it is clear that recognition cannot be made properly. This is catered for by the parameter **Set OCR Retries**.

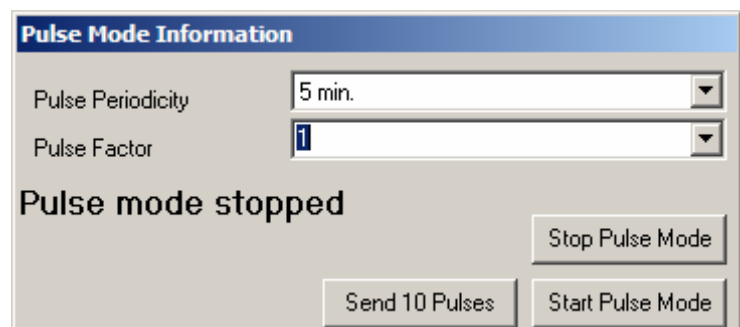


If the OCR fails, a further attempt is made after waiting 3-4 seconds, up to the number of retries defined by this parameter.

The default value is 2, which is recommended by Xemtec AG to avoid unnecessary use of the battery in the device.

15. Click **Set Pulse Mode**. The settings here define the way the pulse output functions.

Pulse Periodicity is the time between performing OCR's. In the example shown, the OCR is made every 5 minutes. The difference compared with the previous register value is calculated and a package of pulses is output.



Note on Pulse Periodicity

This value should not be set too low, because it wakes the Comet device, which is asleep between performing OCR's. A low value means that the device is "woken up" frequently, which can put a drain on the battery.

The **Pulse Factor** is a multiplier which is applied to increments of the last digit recognised by the OCR. For example, if the pulse factor is set to 3, an increment of 1 in the last digit will generate 3 pulses at the output.

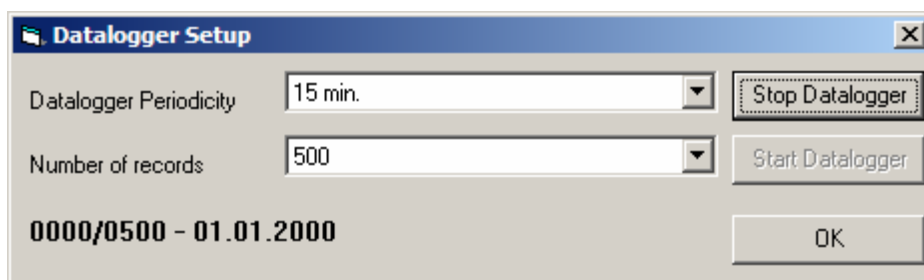
Click **Start Pulse Mode** to activate the pulse output.

Check that the pulse output is operational by clicking on **Send 10 Pulses**. These pulses can be recorded on an external pulse counter or data logger connected to the module.

Note on Comet time synchronisation

Before proceeding to the next step, ensure that your computer has been set to the correct date and time. Your computer time will be downloaded to the Comet device during set-up of the data logger module. If your computer time is incorrect, then the time in the Comet device will also be incorrect. The stored values in the Comet device will then not be matched properly to the real time.

16. Click **Set up Datalogger**. This pop-up window defines the way in which values are stored in the internal data logger module in the Comet device.



Datalogger Periodicity is the integrating period to be used in the module, which should correspond to the one used for energy profiling and/or billing purposes.

Number of records defines how many values are to be stored in the

module's memory. In the example shown, this is 500 15-minute values.

The module can store up to 1500 values, which corresponds to 31 days with 30-minute values.

After setting these two parameters, click on **Start Datalogger**. The datalogger memory in the Comet module is reset, which is shown by the figures in the lower left of the pop-up window, which indicate 0 values are currently stored out of the 500 available. The initial date of the store is reset to 01.01.2000. As values are stored at the defined intervals, these figures are updated to reflect the current status of the module's memory.

This completes the basic configuration of the module. See chapter 5.2.3 for additional settings for the Comet XRS-60 with integrated radio transceiver.

5.2.3 Additional Configuration Details for Comet XRS-60

General information on the Comet XRS-60:

The Comet XRS-60 is an OCR device that is equipped with an on-board low-power radio module, which is in the ISM band at 868 MHz.

The Comet XRS-60 low-power radio module complies with 1f class annex g1 of the ESTI 300-220-1 standard:

- Frequency range: 868.000 to 868.600 MHz
- ≤ 14 dBm (25 mW) emitted radiated power
- < 1 % duty-cycle (on a per-hour basis) using Listen Before Talk (LBT) procedure
- No spacing channels specified

The Comet XRS-60 device derives from the EN 13757-4:2005 standard for the following radio specifications:

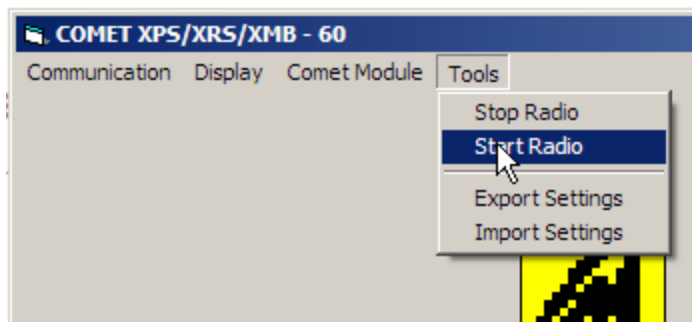
- Channels: 10 channels of 60 kHz each (from 868.030 MHz to 868.570 MHz)
- Bit-rate: The default baud rate is 19.2 kbps. It can also be programmed to 4.8 kbps, 9.6 kbps with an excursion of 20 kHz (except for 4.8 kbps with an excursion of 5 kHz)
- Wake-up period: 1 second (typical)
- Packet size: 255 bytes (excluding protocol overhead)
- 2-level FSK bit-coding with synchronisation (See Semtech XE1202A data sheet)

Set-Up of the Comet XRS-60

To set up the Comet XRS-60 module for radio transmission, after first completing all the steps as for the Comet XPS-60, carry out the following additional steps:

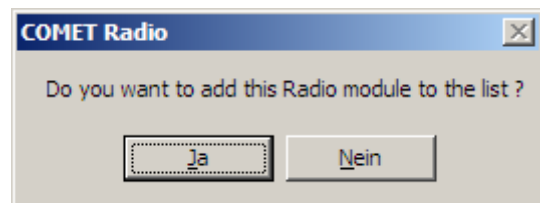
1. In the **Tools** menu, click on **Start Radio**. The integrated radio in the Comet module is switched on and is now able to communicate.

Since the radio uses the configuration parameters already made, and is addressed by its serial number, no further local configuration is required.



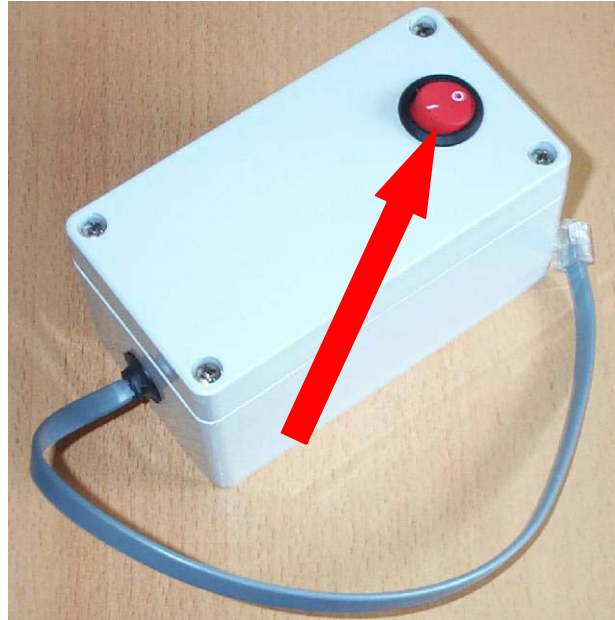
2. A pop-up window opens, asking if the Comet XRS-60 radio module is to be added to the list stored by the **Demo** program.

Click **Yes** to accept the newly installed module.

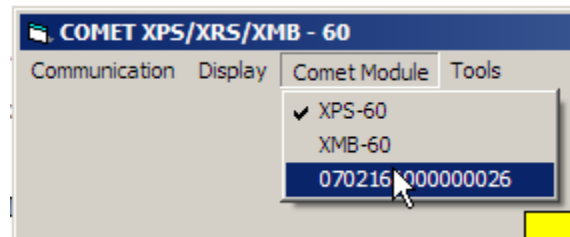


3. Disconnect the serial link between the computer and the Comet XRS-60 module. Further RF readouts will be made using the RF Key shown in the photograph on the right.

Connect the RF Key to the serial port of your computer and switch on the device using the red switch on the front cover. It is also possible to use a USB to serial adapter, similarly to the direct connection between the computer and the Comet module, as described in chapter 5.2.1.



4. Select the serial number of the required module from the list in the **Comet Module** menu.



5. Make a check that the radio connection is functioning correctly by clicking on **Perform OCR** and ensuring that the results are as previously obtained with the serial connection.

Installation and parameter setting for the Comet XRS-60 optical reading module are now complete and the device is ready for operation within the system.

General System Information for the Comet XRS-60

This topic provides some additional general information on systems which employ radio communication from the Comet XRS-60 to a local XEMGATE-200 Gateway.

The photograph on the right shows a XEMGATE-200 Gateway, which can communicate with up to 10 locally installed Comet XRS-60 optical reading modules.

The gateway communicates with a server via GSM/GPRS, and uses low-power radio-frequency in the 868-MHz licence-free ISM band for communication with the Comet modules.

Details for configuration of the XEMGATE-200 and its use within a system are treated in separate documentation.



XEMGATE-200 Gateway

6 Technical Specifications

6.1 Operating specifications

Ambient operating temperature: -20 ... +60°C
Storage temperature: -20 ... +60°C

6.2 External Connections

RJ12 socket (female)

- Pin 1 Comet Rx (Tx for external device)
- Pin 2 unused
- Pin 3 GND
- Pin 4 Pulse
- Pin 5 unused
- Pin 6 Comet Tx (Rx for external device)

Hardware Protocol

The hardware protocol is defined as follows:

- Baudrate: 19200 bauds in regular communication
(2400 bauds in wake-up mode)
- Parity: none
- Data bits: 8
- Stop bits: 1
- Hardware flow control: none
- Software flow control: none

The pins are unprotected and have the following operating parameters:

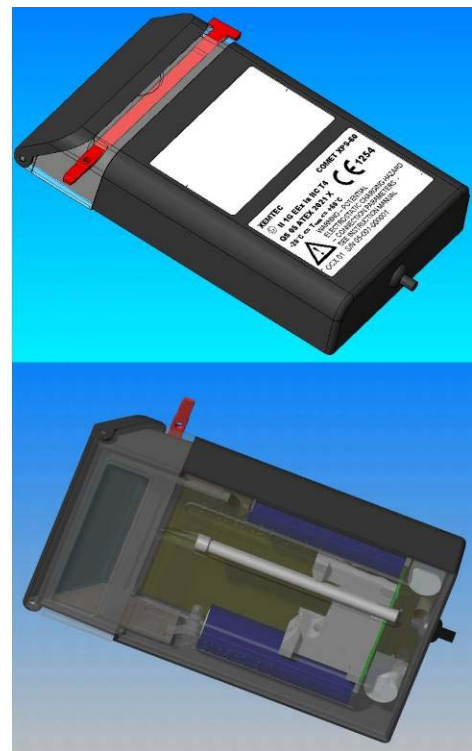
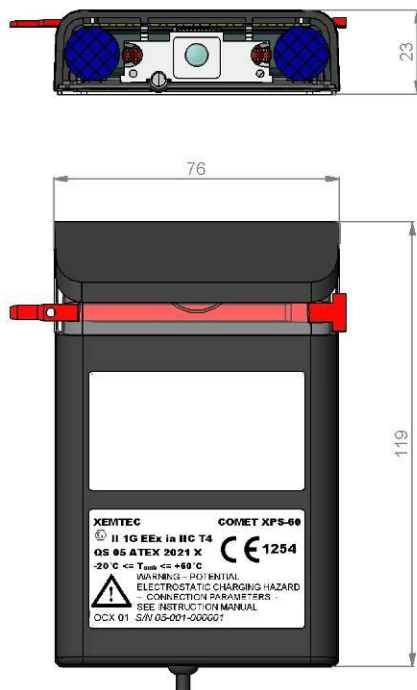
Rx and Pulse:

$U_i = 25 \text{ V}$
 $P_i = 300 \text{ Mw}$
 $L_i = 0$
 $C_i = 0$
 $C_o = 100 \text{ nF}$

Tx:

$U_i = 5.5 \text{ V}$
 $I_i = 55 \text{ mA}$
 $L_i = 0$
 $C_i = 0$
 $C_o = 100 \text{ nF}$

6.3 Design & Dimensions



Dimensions: 116 x 76 x 22 mm

Weight: 175 g

6.4 Battery

Comet XPS-60 and XRS-60 optical reading modules are equipped with two AA-size lithium thionyl chloride batteries of nominal voltage 3.6 V and a capacity of 2000 mAh each.

The batteries are not field-exchangeable and are integrated in the sealed enclosure of the reading module.

The battery manufacturer provides evidence of appropriate safety precautions, particularly related to short-circuit discharge protection (approved in accordance with the UL 1642 security standard)

6.5 Enclosure

The enclosure is manufactured from lightweight durable plastic and is permanently sealed. Since the module is also intended for use in areas with explosive gases, the user may not open the module. There are no user-serviceable parts.

6.6 Intrinsic safety

Comet XPS-60 and XRS-60 modules are certified as ATEX intrinsically safe equipment for use within Ex-hazardous areas classified as Zone 0 according to IEC/CENELEC.

If there is any reason to suspect that the safety of the unit has been affected, then it must immediately be withdrawn from use and precautionary measures taken in order to prevent any further deployment in Ex-hazardous areas. It is recommended that the equipment be sent back to the manufacturer for testing.

The safety and integrity of the unit may be compromised by, for example:

- External damage to the housing
- Exposure to excessive loads
- Incorrect storage of the unit
- Damage sustained in transit
- Correct certification is illegible
- Functionality errors occur
- Permitted limitations are exceeded

Use of the intrinsically safe unit meets the requirements of the regulations provided that the user observes and applies the requirements as laid down in the regulations and that improper and incorrect use of the unit is avoided.

EC Certificate of Conformity No.: **QS 05 ATEX 2021X**
 QS 06 ATEX Q2034

Ex-Designation:  **II 1G EEx ia IIC T4**

Approved for Zone 0, Equipment group II, gas group C (explosive gases, vapours or fog), temperature class T4.

6.7 CE Conformity Declaration

We, **XEMTEC AG**
Güterstrasse 3
CH-6060 Sarnen

declare under our sole responsibility that the products

Comet XPS-60 and Comet XRS-60

to which this declaration relates are in accordance with the provisions of the following directives:

94/9/EC	Equipment and protective systems in potentially explosive atmospheres
89/336/EEC	COUNCIL DIRECTIVE of 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility

and are in conformity with the following standards or other normative documents:

EN 60079-0:2004	Electrical apparatus for explosive gas atmospheres - Part 0: General requirements
EN 50020:2002	Electrical apparatus for potentially explosive atmospheres - Intrinsic safety "i"
EN 60079-26:2004	Electrical apparatus for explosive gas atmospheres – Part 26: Construction, test and marking of zone 0 electrical apparatus.

