Telepole Wide Range

Operating & Maintenance Manual

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MGP INSTRUMENTS
synOdys Group

REVISION LOG: Telepole Wide Range Operating & Maintenance Manual

Revision #	Date	Revised Pages	Comments
0	6/01/1998	N/A	Original Document number PRIR28T8.DOC
1.0	6/03/99	1 - 4 Chapter 5 Chapter 7 Chapter 8 16,46,47 48,49,50	Updated version, revision log, table of contents. Calibration instructions modified. Electronic Block diagrams description chapter added. Troubleshooting chapter added. Appendix 2 – Calibration. Appendix 3 – Rotem Meter View Software Updated title page to reflect all MGPI manuals.
2.0	2/1/02	9	Section 3 – clarification of beep pattern for self test acknowledgement. Clarification of note pertaining to low range detector connection at start-up.
3.0	5/1/2007	pg 17 Pg 10	Corrected F4 calibration Factor to 200 R/hr Added wording about optional WRM2 radio kit Added comments on optional firmware for new switching for detectors.

MGP Instruments reserves the right to change specifications without advance notice

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1. The TelePole WR Meter

1.1. General Description

The **TelePole WR** (Wide Range) is a gamma meter, mounted on a telescopic pole, designed to obtain readings in wide radiation fields. The detector, with its two GM tubes, features a wide measurement range of 50 µR/h to 1000 R/h (0.5 µSv/h to 10 Sv/h).

The rugged, low maintenance **TelePole** can be used as a stand-alone instrument or it can be integrated into systems, using existing equipment and software.

The **TelePole'**s auto-ranging meter utilizes a combination display consisting of a smoothed digital readout for minimum fluctuation and a two-decade analog bar graph for fast response. The four-segment, sturdy, low cost pole extends to eleven feet long and collapses to three and a half feet for easy transport. The **TelePole** includes a built-in microprocessor, data memory, and data downloading capability and optional laser bar-code scanner for use with the survey mapping software.

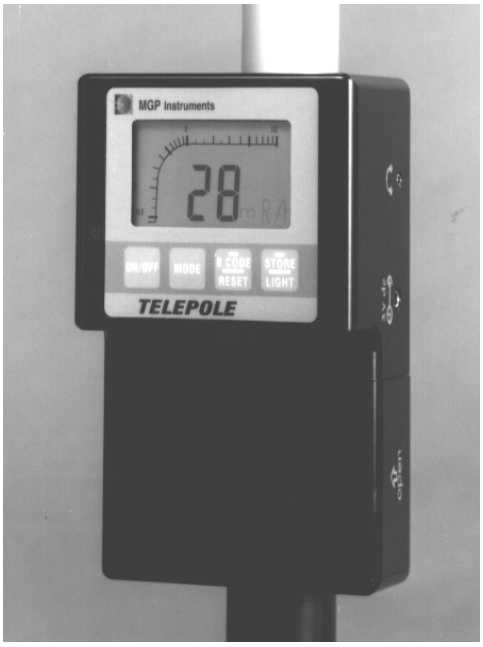


Figure 1-1. TelePole Meter

1.2. Features

- Wide measuring range.
- Rugged, sturdy construction combined with low cost replacement parts.
- Built-in RJ-11 connection for use with a WRMPlus transmitter.
- Optional WRM2 Radio Kit Part Number WR2-A005
- Built-in RS-232 communication.
- Internal alarm thresholds for exposure rate.
- Dual-output “DigiLog” display combines a stable and accurate digital readout with a fast responding analog bargraph.
- Display backlight offers bright illumination for use in low light areas.
- External DC power supply connection.
- External headphone connection.

1.3. Applications

- Supports ALARA principles by allowing operators to obtain readings at a distance of up to eleven feet away from the radiation fields.
- Survey instrument, either with simple data storage, or optional bar-code scanner, data memory and data downloading to survey mapping software.
- Real-time exposure rate monitoring connected to a WRM transmitter. Transmitted data conforms to existing MGPI monitoring software (i.e. WinWRM2, TeleView 2000).

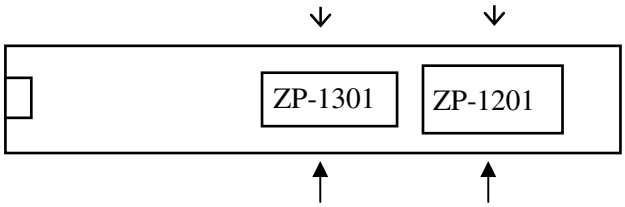
  Note: *The dose function of the software displays "888888.88" when transmitting data, since no accumulated dose function exists on the telepole instrument.*
- Areas that are hard-to-reach. (i.e. vehicle surveys, elevated piping, etc.)

2. *Specifications*

Detector		GM tube ZP-1301 (or equivalent) - high range GM tube ZP-1201 (or equivalent) - low range
Measuring range		0.05 mR/h to 1000 R/h (0.5 µSv/h to 10 Sv/h) Automatic switching between the two GM tubes at approximately 800 mR/h and 600 mR/h, optional firmware to switch 2500 mR/h and 2000 mR/.h.
Accuracy		±10 % of reading, within the measuring range
Energy response (Cs-137)		±20 % at 70 keV to 1.1 MeV
Sensitivity (Cs-137)		Approximately 17 cps/mR/h (low range) Approximately 0.3 cps/mR/h (high range)
Data logging		380 data records (1550 with extended memory)
Display		DigiLog (3 digits and 2 decades of analog bar graph)
Power source		Two 1.5 Volt C-type alkaline cells, 70 hours of continuous operation (30% less if back light is kept on continuously)
Temperature range		Operation: -10°C to +50°C (15°F to 122°F) Storage: -20°C to + 60°C (-5°F to 140°F)
Humidity range		10% to 95% RH (non condensing)
Casing Material		Aluminum, black anodizing
Dimensions	**Meter**	Width: 93 mm (3.7") Length: 148 mm (5.8") Height: 56 mm (2.2")
	Probe head	Length: 226 mm (8.9") Diameter: 33 mm (1.3")
	Pole length	Extended: Up to 337 cm (11 ft)
	Pole length	Collapsed: Down to 107 cm (3.5 ft)
Weight	**Meter**	680 gr. (1.5 lbs.)
	Probe	175 gr. (0.39 lbs.)
	Pole	1200 gr. (2.7 lbs.)
	Total	2055 gr. (7.29 lbs.)

Meter probe connection Standard phone cable

Calibrate/Measuring direction



Response time for small changes

Radiation field [mR/h]	Response time [sec.]
< 0.6	45
0.6 - 2.5	20 - 30
2.5 - 20	5 - 10
20 - 60	2 - 4
60 - 400	2
400 - 2 R/h	2 - 6
2 R/h - 10 R/h	2 - 3
> 10 R/h	≤ 2

The response time for the increased changes in radiation field is faster for rising filed values then for decreasing changes..
The increased change in response depends on the current reading and the extent of the change in field. Generally it will be less than 2 sec.

3. Operating Instructions

3.1. Preparation for Use

Remove the instrument from the shipping container and check for any physical damage. In the case of damage, report it immediately to MGP Instruments.
Do not attempt to install or operate damaged equipment since safety and performance may be affected

3.2. Starting-up

Ensure that the detector is connected to the meter. Press the ON/OFF push-button. For pre-1999 models, when the meter is turned on, it carries out a short self-test procedure indicated by displaying all the segments on the display and emitting two beeps for a short period. Following the test, the meter is ready for use. For 1999-present models, when the meter is turned on, it emits a single beep, then followed by three shorts beeps indicating the self-test procedure is completed and the meter is ready for use.

Note: When the meter is turned on, the low range GM Tube is not connected. As a safeguard, the high-range GM Tube is connected (>600 mR/hr) in the event that the user is in a high exposure rate field. *If the radiation field measurement is lower than 600 mR/h, the meter switches to the low range GM Tube.*

3.3. General Functions

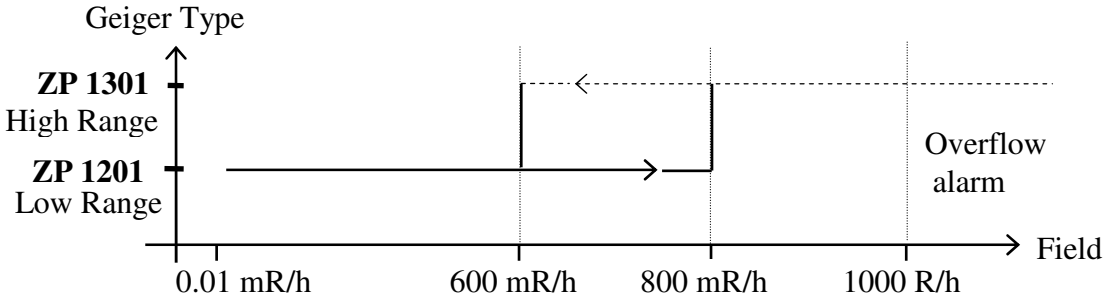
3.3.1. Exposure rate Display

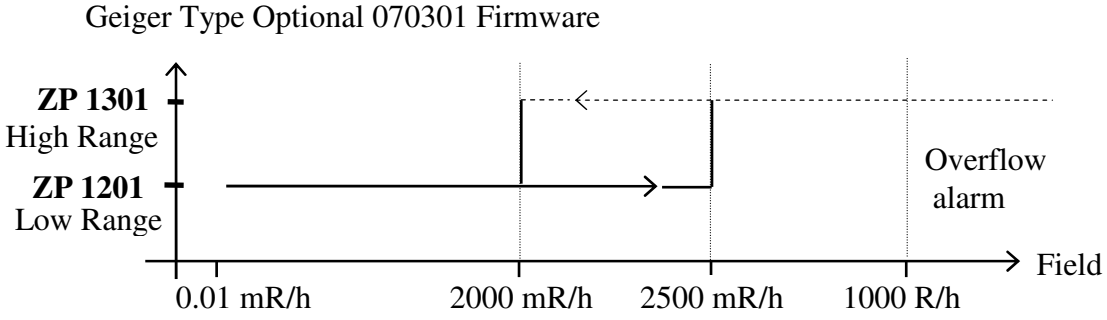
The TelePole measures Exposure rates in the range of 0.0 1mR/h to 999 R/h.
Readings are displayed in digital and analog mode. The ranges in the bar graph are changed automatically and the units displayed correspond to both, the digital and analog display. The bar graph measuring response is quicker than the digital display response since the latter averages the readings.

3.3.2. Automatic Range Switching:

The detector includes two Geiger: Low range - ZP-1201 (or equivalent), and high range - ZP-1301 (or equivalent).

In a field of 0.01 mR/h to 800 mR/h both geigers are connected and the field is measured by the low range geiger. In case the radiation field is higher than 800 mR/h (Optional Firmware '070301' 2500 mR/h), the low range geiger is disconnected, and the radiation field is measured by the high range Geiger. The switching between the low and high range geigers is done at 800 mR/h when the radiation field increases (low range geiger is disconnected), and at 600 mR/h (Optional Firmware 2000 mR/h) when the radiation field decreases (low range geiger is connected).





3.3.3. Reading reset:

Exposure rate - While in Exposure rate mode, a long press on the RESET push-button enters the meter into the FREEZE mode (for peak measuring). An additional long press performs a momentary reset of the Exposure rate readings.
The reset function provides a rapid means of discharging the Display reading and enables accurate measurement of low level Exposure rates.

3.3.4. Audible announcements:

When the meter is turned on, the radiation field intensity is observed by the click rate. A long press on the MODE push-button toggles the click on and off.
Each push-button press is accompanied by an audible beep.
In case of threshold alarm or failure alarm the audible alarm is activated. To mute the audible alarms press the RESET push-button.

3.4. Threshold Selection

A threshold value can be selected from a series of 11 threshold values. The value is kept in memory even if the meter is turned off or if power is lost.

Threshold values:
Exposure rate : 2.00, 5.00, 50.0, 100, 500 [mR/h], 1.00, 10.0, 200, 400, 800, 999 [R/h]
To choose the required threshold value, proceed with the following steps:

3.4.1. Enter threshold mode by pressing the MODE & RESET push buttons simultaneously. The threshold readings, the SET and RATE segments and the SPK icon will be displayed.

3.4.2. Each short press on the RESET push-button advances the display to the next threshold value, according to the order described in section 3.4.

3.4.3. To exit the set threshold mode, save and set the new threshold value, press the MODE & RESET push buttons simultaneously. An audible beep will verify that the new threshold value was saved.

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3.5. Alarms

***a. Detector alarm*:** The **Err.** LCDs and **SPK icon** will blink on the display in three cases:

1. The detector is disconnected.
2. The detector high voltage power supply is defective.
3. The detector is located in a background radiation field < 600 mR/h and the low range Geiger is defective.
4. If the detector is located in a radiation field higher than 800 mR/h and the meter displays the following sequence of readings: 800 mR/h, 600 mR/h, 0.00 mR/h - this indicates the high range geiger is malfunctioning.

Note: It is recommended to check the meter and the detector with a calibration source, to ensure correct operation. Check:
Background field during two minutes,
50 mR/h for the low range Geiger,
5.00 R/h for the high range Geiger.

To mute the audible alarm, press the RESET push-button.

***b. Battery alarm*:** If battery voltage decreases below 2.2V, the **battery** and **SPK** icons blink on the display, and an interrupted audible alarm is activated.
To mute the audible alarm, press the RESET push-button.

***c. Overflow alarm*:** If the displayed Exposure rate is over 999 R/h, the **O.F.** LCDs and **SPK** icon will blink on the display and an interrupted audible alarm will be activated. To mute the audible alarm, press the RESET push-button.

***d. Threshold alarm for Exposure rate*:** If the Exposure rate reading exceeds threshold value, the **RATE** LCDs and **SPK** icon will be displayed, accompanied by an audible beep.
Pressing the RESET push-button mutes the audible alarm, but the **RATE** LCDs, the **SPK** icon and the reading continue to be displayed, until the reading decreases to 75% of threshold value. In case the reading exceeds threshold value and then decreases to below 75% of the threshold value, the **RATE** LCDs, the **SPK** icon and the beep sound will automatically cancel, even though the RESET push-button has not been pressed.

3.6. Push-buttons Function

Function	Pressing mode	Push-buttons
Meter on/off		ON/OFF
Speaker beeps on/off	Long	MODE
Operates laser bar-code reader, the **bAr.** LCDs are displayed. When the barcode is successfully read the **Go.** LCDs are displayed, accompanied by an audible beep. In case of an alarm condition (threshold or malfunction) the beeper is activated. Pressing the RESET push-button turns the beeper off.	Short	B.CODE RESET
In Exposure rate mode, the first press enters the FREEZE mode, the second press returns to Exposure rate mode and resets the reading.	Long	B.CODE RESET
Stores the reading value. Displays the left available memory space.	Short	STORE LIGHT
Displays back light on/off.	Long	STORE LIGHT
Threshold Set mode / measurement mode.	Simultaneously	MODE + RESET
Selects one of eleven threshold values.	Short	RESET
Clear data from the meter's internal memory.	Two sequential Long pressings (10 sec)	B.CODE RESET

3.7. Battery Replacement

Note: *The battery compartment is located on the lower right side of the TelePole's meter.*

3.7.1. ***Slide out the battery compartment cover in the direction of the arrow (open). See Fig. 3-1***.

3.7.2. ***Insert two C-type alkaline batteries with the correct polarity***.

3.7.3. ***To close of the battery compartment, press the batteries down, place the compartment cover on the battery edge, press the batteries down with the compartment cover and slide the cover into place along the side slots***.

Using an External Power Supply

Power can be supplied to the meter in one of two ways:

1. Ordinary batteries - default use. When an external 3V DC power supplies is connected, the internal batteries will be disconnected.
2. Rechargeable batteries - on request. A 2.9V to 3.2V external power supply charges the batteries. A jumper on the printed circuit performs the interchange.

Warning: *Ensure to connect the external power supply with the correct polarity, as indicated on the instrument battery compartment.*

Figure 3-1. TelePole Battery Compartment

4. Communication

4.1. Survey Mapping Communication

The TelePole is compatible with the survey mapping software. An External Laser Scanner or a Smart Wand (laser pen) may perform the scanning of the bar code. The bar-code reader is connected to serial port COM-1 located on the instrument rear panel.

Following is the operating procedure**.**

4.1.1. ***A short press on the B.CODE push-button turns the bar-code reader on. Three short beeps will be sounded. The*** *bAr.* ***LCDs are displayed***.

4.1.2. ***If the bar-code reading is successful, the*** *Go.* ***LCDs will be displayed***.

4.1.3. ***To save the instrument data (ID, time, date, value, unit, comments) perform a short press on the STORE push-button***.

4.1.4. ***After the saving operation, the amount of available memory space remaining is displayed***.

4.1.5. ***To load data from the TelePole to the survey mapping software, connect the RS232 of the PC to COM-1 on the TelePole rear panel by a special communication cable (supplied with the software system). Downloading data from the TelePole to the PC clears the instrument's memory. TelePole can store up-to 380 readings (or 1550 optional with extended memory)***.

Warning: *To purposely clear data from the TelePole's memory press the B.CODE push-button for 10 seconds, the current available memory space is displayed for an additional ten seconds. An additional press on the B.CODE push-button within the ten seconds erases the data. The instrument indicates it by four audible beeps and* ***380 m****, the new available memory space is displayed.*

4.2. WRM Communication

The WRM transmitter is connected to the serial port COM-2 located in the instrument's rear side via a standard telephone cable. The additional operations like transfer of data, are performed automatically. The WRM communication protocol includes accumulated dose data. ***Note:*** *The TelePole does not measure accumulated dose, therefore instead of transmitting the accumulated dose value, it transmits the digits 888888.8.*

4.3. WRM2 Communication

The WRM2 optional kit(WR2-A??) is connected via two screws on the meter box and is powered by the same power supply that powers the TelePole. The transmission interval level is defaulted 4 seconds and can be changed using the Meter View software with the communication cable designed for the TelePole and the Ram Ion and the baud rate to the Telepole when using the WRM2 radio is set to 19,200 BPS. The WRM2 kit is available to older instruments built 2006 or later and require new firmware and two wired jumpers installed. Instruments built in 2007 or greater are pre-configured for the WRM2 Telepole kit. ***Note:*** *The TelePole does not measure accumulated dose, therefore instead of transmitting the accumulated dose value, it transmits the digits 888888.8.*

4.4. RS-232 and WRMPlus Connection

Communication parameters	**COM-1**	**COM-2**
Baud rate:	9600	300
Parity:	None	None
Hardware handshaking:	None	None
Software handshaking:	None	None
Stop bit:	One	One
Prefix:	01	LF
Suffix:	04	CR
Data format:	8 data bits	8 data bits

4.5. With Optional WRM2 Kit Data Connection

Communication parameters	**COM-1**	**COM-2**
Baud rate:	19,200	19,200
Parity:	None	None
Hardware handshaking:	None	None
Software handshaking:	None	None
Stop bit:	One	One
Prefix:	01	LF
Suffix:	04	CR
Data format:	8 data bits	8 data bits

5. Calibration Instructions

5.1. Preface

5.1.1. Calibration Factors

To improve the linearity, the **TelePole** uses five calibration factors: The two lower factors are for the low range Geiger, from 0.01 mR/h to 800 mR/h; and the other three are for the high range Geiger, from 1000 R/h to 600 mR/h.

Note: Optional Switching 070301 Firmware; the two lower factors are for the low range Geiger, from 0.01 mR/h to 2500 mR/h; and the other three are for the high range Geiger, from 1000 R/h to 2000 mR/h.

The calibration factors will be displayed on the meter, as follows:

F1 - first calibration factor for low range.

F2 - second calibration factor for low range.

F3 - first calibration factor for high range.

F4 - second calibration factor for high range.

F5 - third calibration factor for high range.

F1 and **F3** are used to compensate the Geiger sensitivity tolerances.

F1 for the low range Geiger (ZP1201) and **F3** for the high range Geiger (ZP1301).

F2, F4 and **F5** are used to compensate the Geiger dead time tolerances.

F2 for the low range Geiger (ZP1201) and **F4**, **F5** for the high range Geiger (ZP1301).

5.1.2. Calibration Ranges

F1 has to be set at 50 mR/h ± 20 mR/h

F2 has to be set at 350 mR/h ± 50 mR/h.

Optional Switching 070301 Firmware: F2 factor must be set at the range of 800 to 1500 mR/h when using the optional switching firmware

F3 has to be set at 10 R/h ± 2 R/h

F4 has to be set at 200 R/h ± 60 R/h

F5 has to be set at 600 R/h ± 100 R/h

Measured (displayed) readings are calculated by one of the following two formulas, depending on the intensity of the radiation field:

Low range: N(mR/h) = [**n***F1 + dead time correction {n*F2}]/17

High range, up to 300 R/h: N(R/h) = [**n***F3 + dead time correction {**n***F4}]/300

High range, over 400 R/h: N(R/h) = [**n***F3 + dead time correction {**n***F5}]/300

Where

n is the detector frequency obtained in the radiation field.

N is the updated measurement reading.

Between 300 R/h to 400 R/h, a weighted average of F2 and F3 is used as the dead time correction factor. The calculation of the "averaged factor" and the corresponding measurement formula follow:

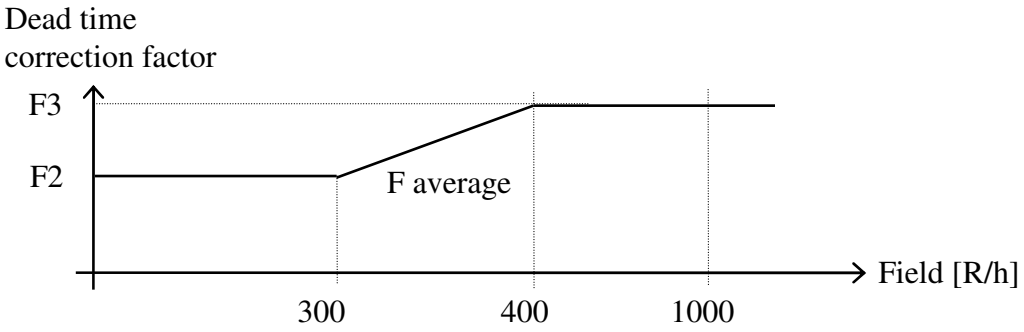
x = (last N(R/h) - 300)/100

Last N = previous measurement reading

F average = (1-x)* F4 + x* F5

N(R/h) = [n*F1 + dead time correction {n*F average}/300

The following graph illustrates the ranges over which F2, F3 and F average are used as the TelePole's dead time correction factor:



5.2. Calibration Procedure (See Appendix 2)

5.2.1. ***To set the TelePole to the calibration mode unscrew the calibration screw located on the back of the meter. Turn the internal switch to the calibration position***.
In a field higher than 10 mRh, the meter automatically enables only the display and setting of the appropriate factor, depending on the field intensity.

F1 if the probe head is in a field higher than 10 mR/h and lower than 100 mR/h.

F2 if the probe head is in a field higher than 100 mR/h and lower than 800 mR/h.

Optional switching 070301 Firmware: F2 factor must be set at the range of 800 to 1500 mR/h when using the optional switching firmware

F3 if the probe head is in a field higher than 800 mR/h and lower than 50 R/h.

F4 if the probe head is in a field higher than 50 R/h and lower than 350 R/h.

F5 if the probe head is in a field higher than 350 R/h

5.2.2. ***Expose the detector to a radiation field of 50 mR/h ±20 mR/h***.
The display will show:

→ F1 → F (factor) → mR/h (reading) →
↑_____↓

Change the factor by pressing the RESET or LIGHT push-button to obtain the desired reading.

5.2.3. ***Expose the detector to a radiation field of 100 mR/h to 800 mR/h. Note: Use calibration points 800 mR/h to 1500 mR/h when using the optional switching 070301 firmware (2000 mR/h – 2500 mR/h).***
The display will show:

→ F2 → F (factor) → mR/h (reading) →
↑_____↓

Change the factor by pressing the RESET or LIGHT push-button to obtain the desired reading.

5.2.4. ***Expose the detector to a radiation field of 10 R/h ±2 R/h***.
The display will show:

→ F3 → F (factor) → R/h (reading) →
↑_____↓

Change the factor by pressing the RESET or LIGHT push-button to obtain the desired reading.

5.2.5. ***Expose the detector to a radiation field of 200 R/h ±60 R/h***.
The display will show:

→ F4 → F (factor) → R/h (reading) →
↑_____↓

Change the factor by pressing the RESET or LIGHT push-button to obtain the desired reading.

5.2.6. ***Expose the detector to a radiation field of 500 R/h to 700 R/h***.
The display will show:

→ F5 → F (factor) → R/h (reading) →
↑_____↓

Change the factor by pressing the RESET or LIGHT push-button to obtain the desired reading.

5.2.7. ***Set the TelePole to the operating mode, turn the internal switch to the operating position***.

5.3. CPU Unit Pulser Check (Option Only)

Note: *Although it is possible to "calibrate" the TelePole using a series of input pulses (from a pulser), the manufacturer strongly recommends against this. Checking instrument response to input pulses ensures that the meter's CPU is operating properly,* ***but indicates nothing about the detector.*** *The manufacturer recommends that the instrument is calibrated according to the previous section (5.2 Calibration procedure), by exposing the probe head to known radiation fields and adjusting factors appropriately, which ensures that both the detectors and the CPU are operating properly.*

The CPU unit counts the input pulses, calculates dead time, averages the results, and displays the reading.
To check the CPU unit "calibration" perform the following procedure:

5.3.1. ***Disconnect the detector telephone connector from the meter***.

5.3.2. ***Adjust the pulser output to obtain a 5 Volts amplitude and 10 μsec width pulse***.

5.3.3. ***Connect the pulser output as follows: (+) to pin 1 and (-) to pin 2***.
Option: A more convenient and easier way to perform this step is by using the TelePole Pulser Adapter. Proceed as follows:
- Connect the adapter telephone cable to the detector connector (**Det.**) on the TelePole.
- Connect the pulser signal output to pin 4 on the adapter board.
- Connect the pulser ground output to pin 3 on the adapter board.

5.3.4. ***First, turn the meter on, and then turn the pulser on. Ensure to obtain the base unit reading (±10%) according to the following table***:

Tab1e 1 - Low Range Geiger

Input Frequency <Hz>	Display <mR/h>
17	1.00
170	10.0
2000	141
4000	365
5000	534
6000	730
6300	804*

* Switch to high range geiger

Table 2 - High Range Geiger

Input Frequency <Hz>	Display <R/h>
300	1.00
3200	10.7
10.000	39.2
30.000	183
40.000	323
50.000	525
60.000	839
75.000	O.F. (overflow)

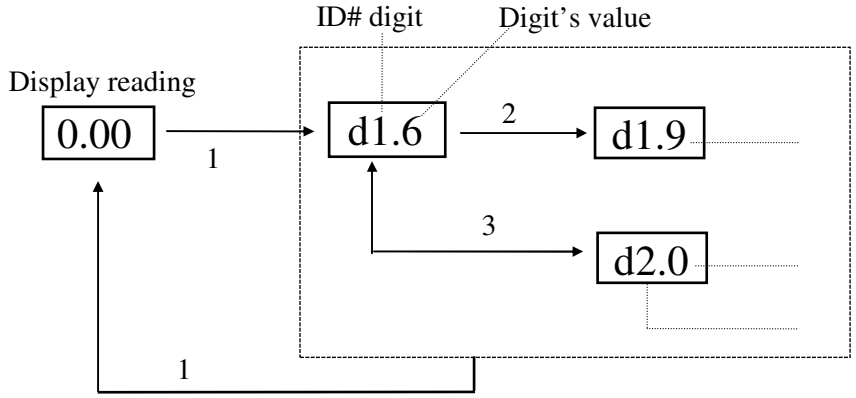
These results are valid only when all factors equal to 1.

6. Setting ID Number

Note: *Setting the ID # must be done only by an authorized user.*
The ID # includes 6 digits.
The second digit in the ID # sets the instrument type. **TelePole**'s first digit is (0).

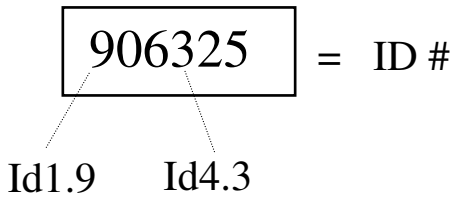
Setting and Checking the ID #:

- Unscrew the calibration screw located on the back of the meter. Turn the internal switch to the calibration position.
- The **SET** LCD's are displayed.

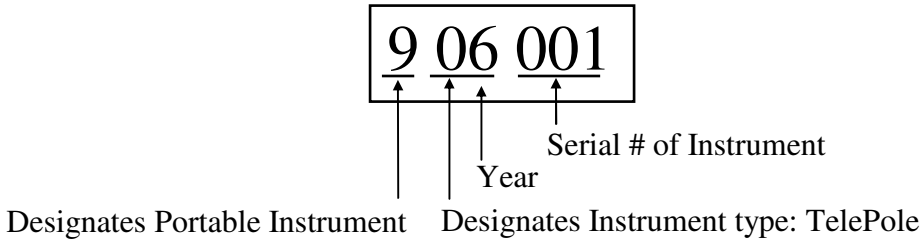


1 - Long press on MODE push-button (5 sec.) - In/out display and set ID #.
2 - Short press on LIGHT push-button - Increases displayed digit value.
3 - Short press on RESET push-button - Displays next digit value.

For example:



The default ID# is:



7. Electronic Block Diagrams Description

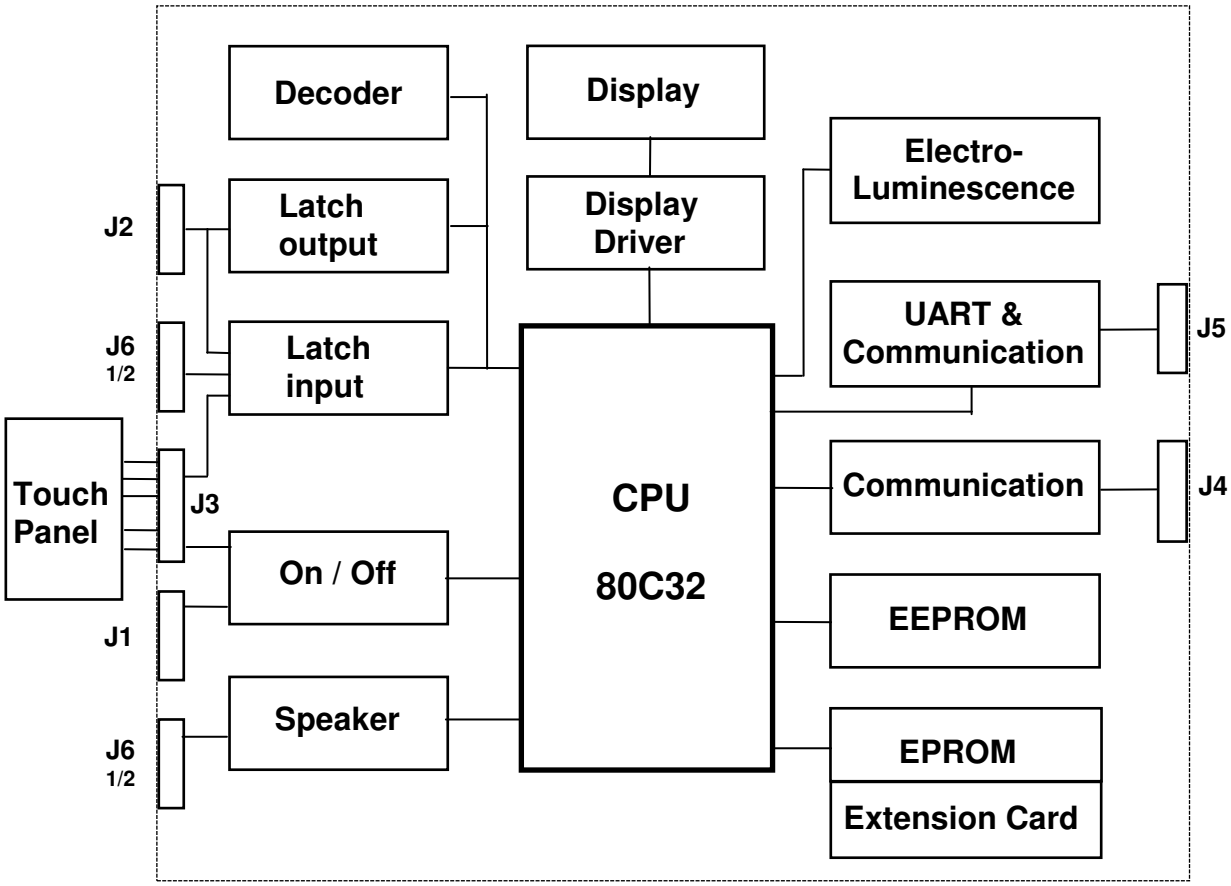
See block & wiring diagram DRW# 12850-50-00.

7.1. Meter

The meter unit includes the CPU and the Power Supply boards.

7.1.1. CPU Board Description

DRW #12850-40-00, PC #1942.



CPU Board Block Diagram

On /Off Circuit (Q3, Q4, Q5)

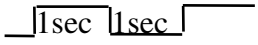
A momentary short between pin J3/1 and J3/2 switches Q3 and Q4 on.
The battery voltage powers the power supply circuit.
U5/5 is set to "1" (in software), Q3 is switched on, and as a result the meter is turned on.
An additional momentary short between J3/1 and J3/2 sets U5/6 to "0" through Q5. U5/5 is set to "0" and the meter is turned off.

Speaker Circuit (U13)

The speaker circuit is activated in the following cases:
a. Threshold level exceeding.
b. Malfunction.
c. Push-button pressing approval.
d. The speaker clicks frequency is proportional to the radiation field intensity.

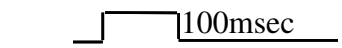
A 3 KHz signal on pin U13/3 activates the speaker. Two ports control the speaker:
Port 1 - alarm, pin U3/9
Port 2 - speaker on, pin U3/19

For threshold level exceeding and malfunction:
U3/9 - "0"
U3/19 -



For push-button pressing approval:

U3/9 - "0"
U3/19 -



For clicks activation in relation to the radiation field intensity:
U3/9 - "1"
U3/19 - "1"

To mute the speaker:
U3/9 - "0".
U3/19 - "1"

Input & Output Latch

Two **74HC373** IC's are used for the input/output signals. The IC's are connected to the CPU BUS.
Input signals - **U9, address** - 8200H
Output signals - **U3, address** - 8100H

Output Signals

0 -	U3/2	external/internal detector (optional)
1 -	U3/5	low range / high range geiger
2 -	U3/6	Electro-luminescence
3 -	U3/9	speaker alarm
4 -	U3/12	not in use
5 -	U3/15	not in use
6 -	U3/16	enables VCC for barcode laser reader
7 -	U3/19	speaker on

Input Signals

0 -	U9/3	MODE push-button
1 -	U9/4	RESET push-button
2 -	U9/7	LIGHT push-button
3 -	U9/8	low battery
4 -	U9/13	not in use
5 -	U9/14	calibration mode
6 -	U9/17	internal geiger (optional)
7 -	U9/18	PC communication

Touch Panel

The touch panel push buttons are connected to the micro-controller chip in the CPU board via input latch, except the on/off push-button that is connected to the on-off circuit.

Display (U17, U18)

DRW # 12850-40-00 sheet 2.

The display shows the meter readings and messages.

The display driver (U17) receives clock and serial data from the CPU and transmits it in parallel to the display in three back planes.

U18 - Rotem's custom display especially designed for the RAM ION and Telepole meters. The display includes 3-character 7-segment, 2 decimal points, bar graph and data segments.

Electro-luminescence (EL, T1, Q1, Q6)

Pressing the LIGHT push-button turns on the display illumination.

U3/6 is set to "1" and activates T1 that supplies 100V AC.

EPROM Circuit (U2, U5) & Extension Card

U2 - 74HC 373, Address A_0 - A_7, latch from AD_0 - AD_7 .

U5 - 27C 256, EPROM contains software code.

The extension card, DRW # 12850-41-00, is installed on the EPROM socket.

The extension card includes EPROM, NOVRAM, Reset and Watchdog circuit.

U2 - NOVRAM: DS1243 8K byte, or DS1244, 32K byte.

The NOVRAM contains: SRAM, clock, calendar and battery back up, used for storing the SMARTS data.

U3 - MAX1232, watchdog and reset circuit. The micro-controller receives a reset signal in two cases:

a. When the meter is turned on.

b. In case of software failure.

Pulses are sent from U6/2 to U3/7 as long as operation runs ok. In case of a fault detection in software, the pulses stop and a reset signal is obtained on U3/6.

CPU Circuit (U6)
The micro-controller circuit manages all the meter activities.

EEPROM Back up Memory (U1)

The X2C04 is a 512-byte serial EEPROM (Electrically Erasable Prom).
The EEPROM stores threshold values, ID number and calibration factors values.

Communication Circuit

The CPU board contains two separate communication ports. One is the micro-controller communication port used for the SMARTS communication:

J4/1 TxD - This is the serial data line transmitted from the meter. The logic level swings are 0 to 5 Volts, and can be described as RS-232 TTL level. This circuit is able to drive TTL, LSTTL, and CMOS inputs.

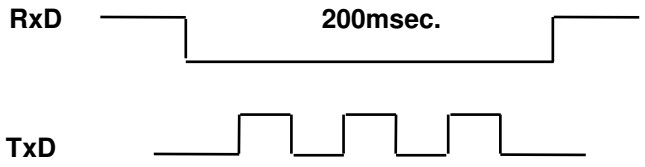
J4/2 RxD - This is the serial data line received in the meter. The meter accepts serial data either in RS-232 signal levels (low: -3 to -15 Volts, high: +3 to 15 Volts) or TTL levels (low: 0.8 Volts, high: 2.0 Volts).
J4/3, 6 - ground
J4/4 - + 5V

UART & Communication
The other communication port is used for the WRM system or COMBO system.
U12 - 82510 is connected to the CPU BUS, address 8700H.

J5/1 TxD - This is the serial data line transmitted from the meter. The logic level swings are 0 to 5 Volts, and can be described as RS-232 TTL level. This circuit is able to drive TTL, LSTTL, and CMOS inputs.

J5/2 RxD - This is the serial data line received in the meter. The meter accepts serial data either in RS-232 signal levels (low: -3 to -15 Volts, high: +3 to 15 Volts) or TTL levels (low: 0.8 Volts, high: 2.0 Volts).
J5/3 - ground
J5/6 - + 5V
J5/7 - trigger from the WRM transmitter

The communication port receives a trigger from the WRM transmitter and transmits the data to the WRM system.

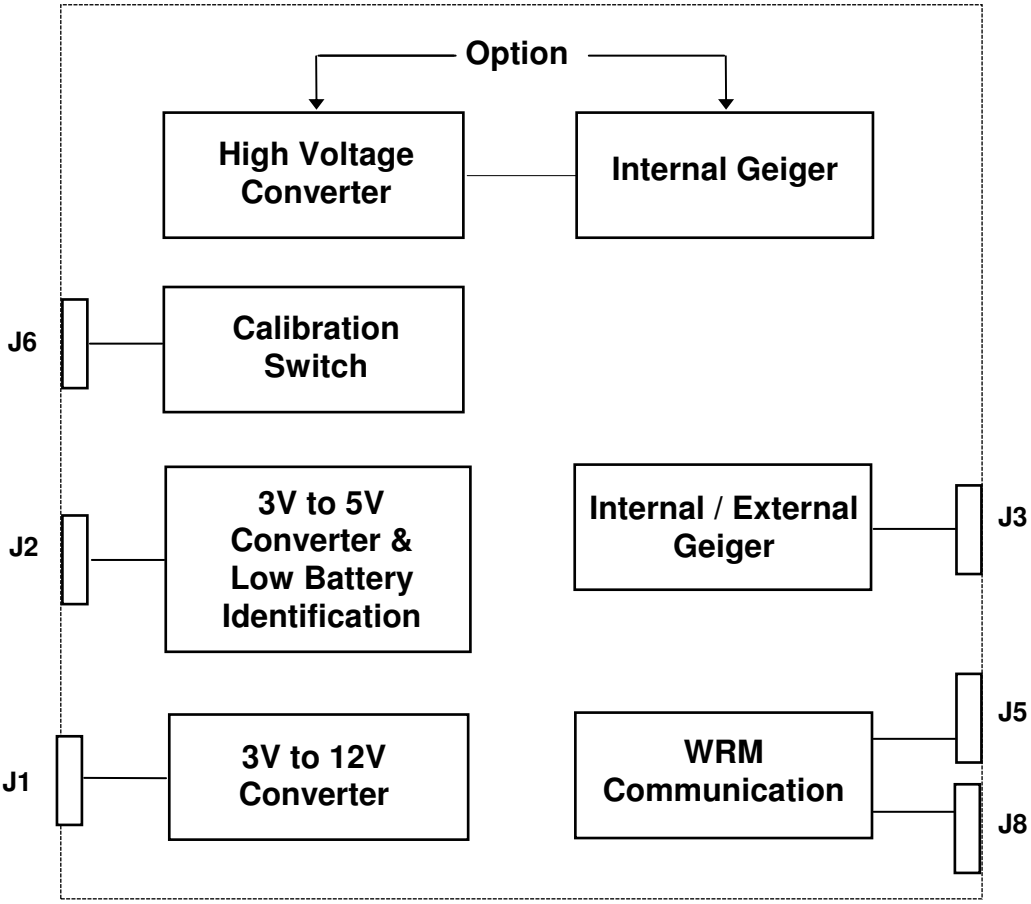


Decoder

U11 - 74HC138, sets addresses for the input/output IC's and UART IC.
Address ranges from 8000H to 8700H.
Three addresses are used:
8100 - input latch U3
8200 - output latch U9
8700 - UART 82510 U12

7.1.2. Power Supply

DRW #12850-42-00.



H.V. Board Block Diagram

High Voltage Converter & Internal Geiger (optional)

The high voltage converter and internal geiger components are installed on the board only when the internal geiger is used. As well, a short is performed on jumper E3. When the microcontroller identifies the short on E3 via J5/5, the internal geiger is activated.

High Voltage Circuit for the Internal Geiger

The H.V. circuit includes an ORAM 5525 transformer, a voltage multiplier (D4, D5, D6, C7, C3), and an RV4192 switching regulator.

R10 and R9 are voltage feedback for the switching regulator.

The high voltage, 500V ±5% generated in the H.V. circuit is transmitted to the geiger. When the Geiger is positioned in a radiation field, positive pulses are obtained on pin K1 of the Geiger. These pulses are shaped and amplified by Q1, Q4 and RC components.

Internal / External Geiger Selection
U2 - 74HC132 and port J2/4 are used to select between the internal and external geiger.
J2/4 enables to select between operation and display of internal geiger or external geiger.
J2/4 = "0" - internal geiger
J2/4 = "1" - external detector.

3V to 5V Converter & Low Battery Identification
MRX756 (U1) and RCL components convert the battery voltage to 5V, (which is) the meter's main power supply.
Input voltage range: 1.7V to 3V DC.
Output voltage range: 5V ±0.1V.

Low battery identification is performed by U1. When the battery voltage reduces below 2.0V on pin LB1, LB0 (pin 4) on U1 resets to "0".

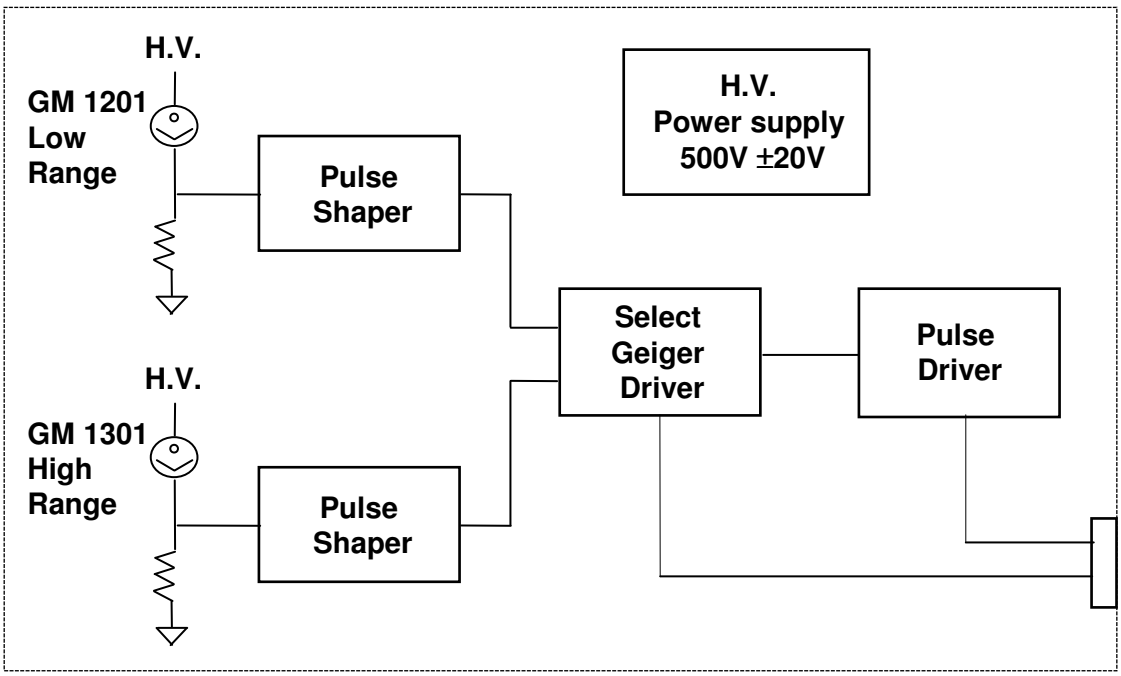
3V to 12V Converter
MAX771 (U4) and RCL components convert the battery voltage to 12V that is aimed for the speaker circuit.

7.2. WRM Communication

Q2, Q3 and resistors adapt between the WRM transmitter and meter voltage levels.
E1 (1-3) should be shorted.

7.3. Wide Range Detector

DRW # 12852-40-00



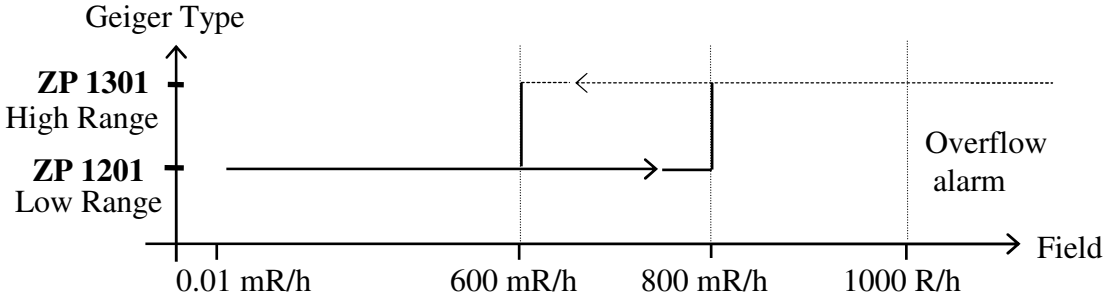
Detector Block Diagram

High Voltage Power Supply
The H.V. board includes an ORAM 5525 transformer, a voltage multiplier (D1, D2, D3, C8, C11), an RV4192 switching regulator.
R3 and R4 are voltage feedback for the switching regulator.
H.V. range: 500V to 550V DC. The high voltage is aimed for both geigers.

Pulse Shaper
Each geiger includes a pulse shaper circuit.
Q3 and RC for the low range geiger 1201.
Q5 and RC for the high range geiger 1301.

7.3.1. Select Geigers

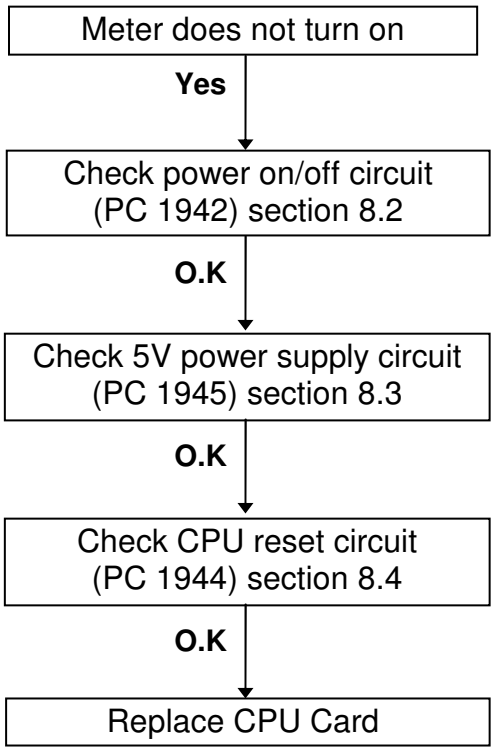
The detector includes two geigers: Low range - ZP-1201 (or equivalent), and high range - ZP-1301 (or equivalent).
In a field of 0.01 mR/h to 800 mR/h both geigers are connected and the field is measured by the low range geiger. In case the radiation field is higher than 800 mR/h, the low range geiger is disconnected, and the radiation field is measured by the high range geiger.
The switching between the low and high range geigers is done at 800 mR/h when the radiation field increases (low range geiger is disconnected), and at 600 mR/h when the radiation field decreases (low range geiger is connected).
Geigers selection is performed via J1/2 control line.



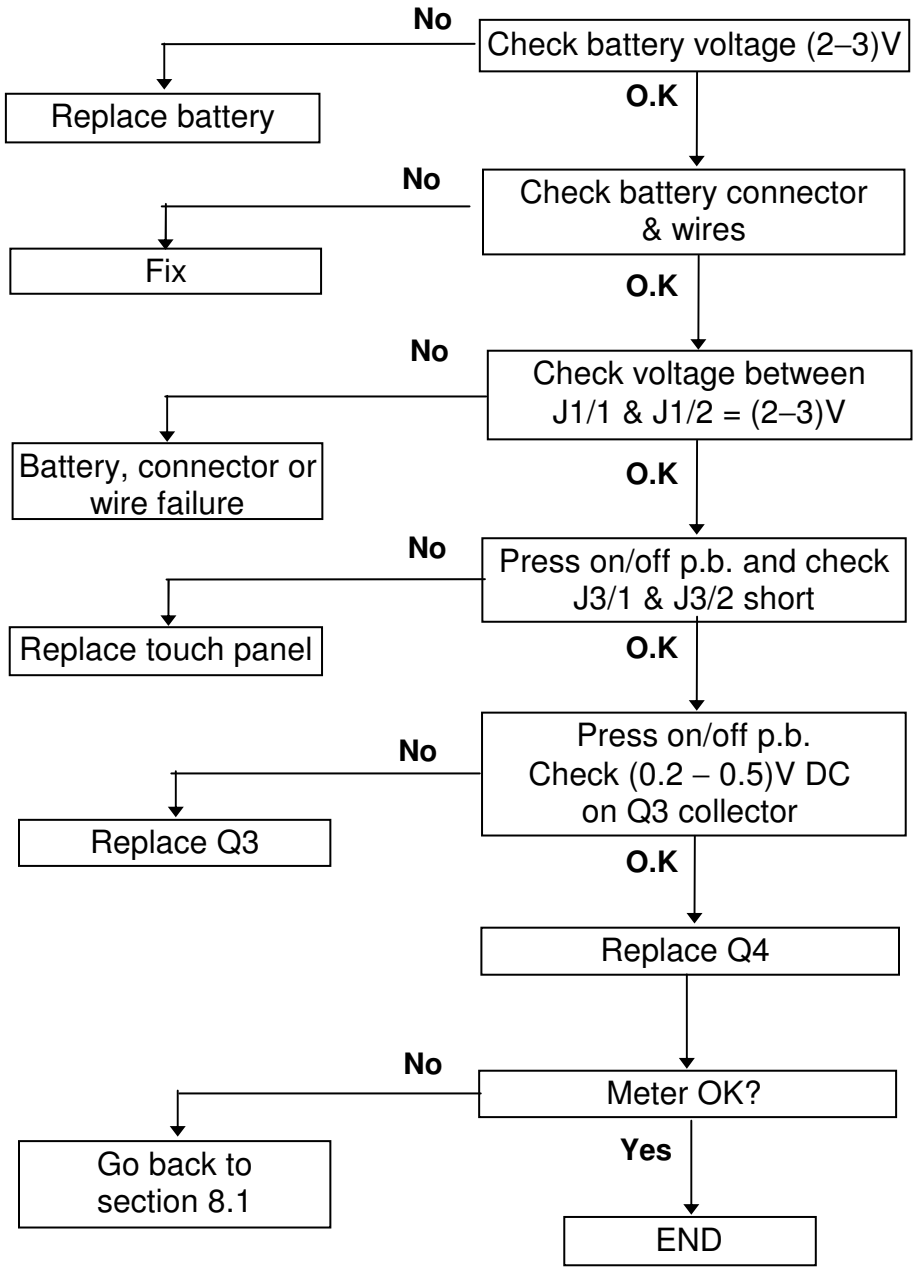
Pulse Drive
Q2, Q4 and R23 drive the detector pulses to the meter.

8. Troubleshooting

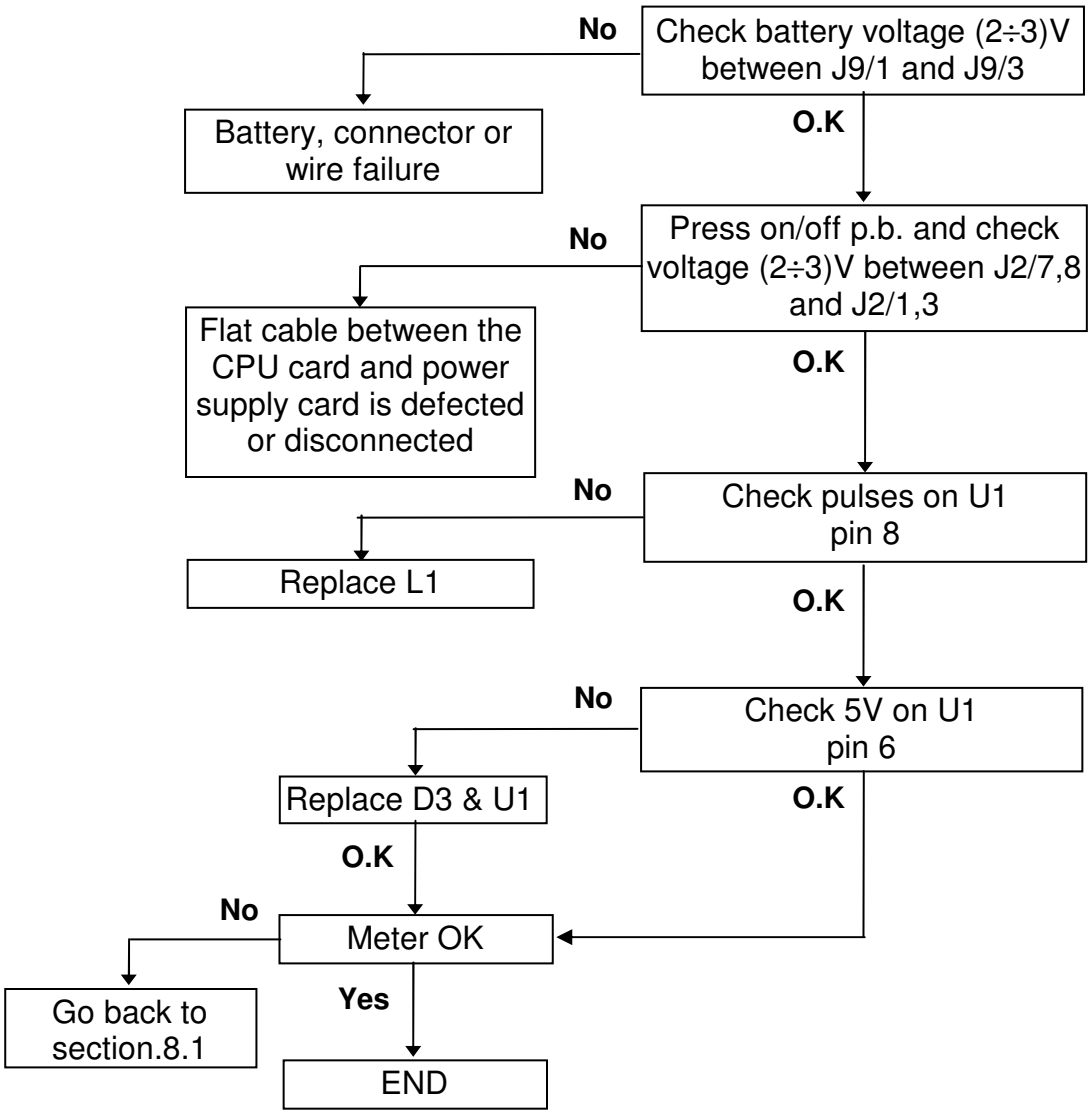
8.1. Meter does not power turn ON



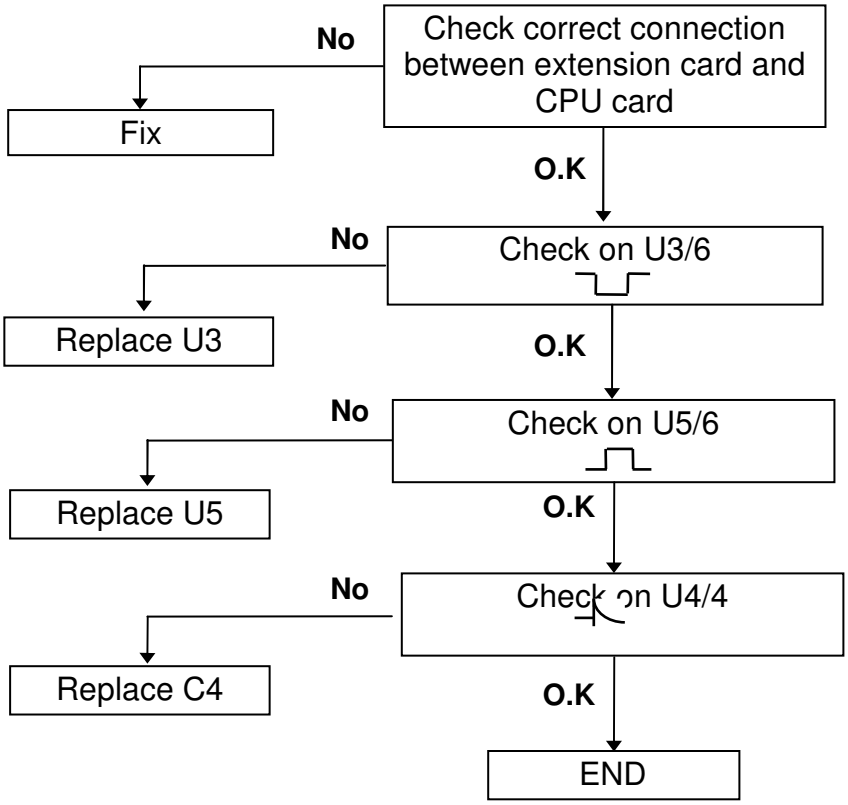
8.2. Power on/off circuit (PC 1942)



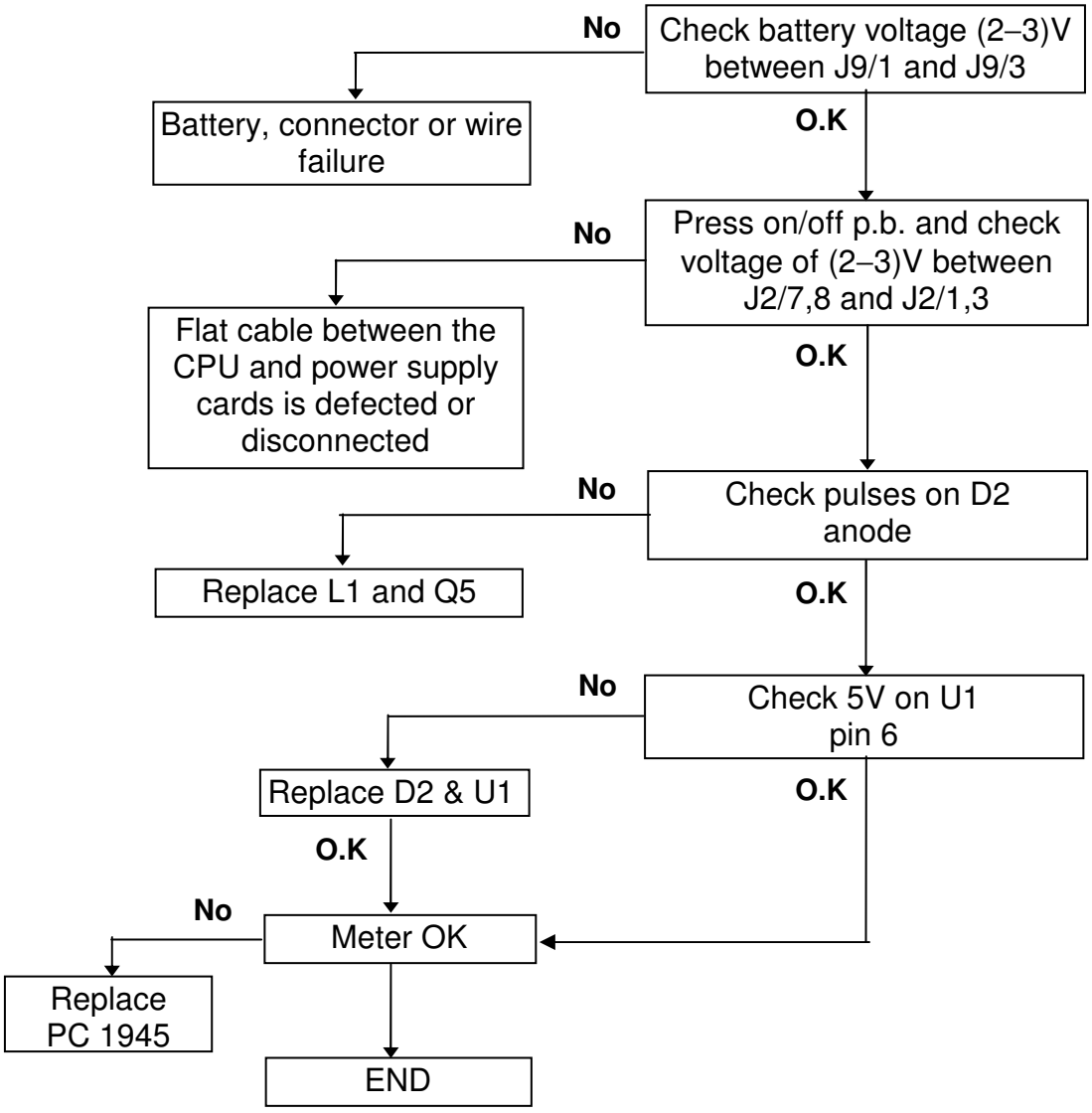
8.3. 5V power supply circuit (PC 1495)



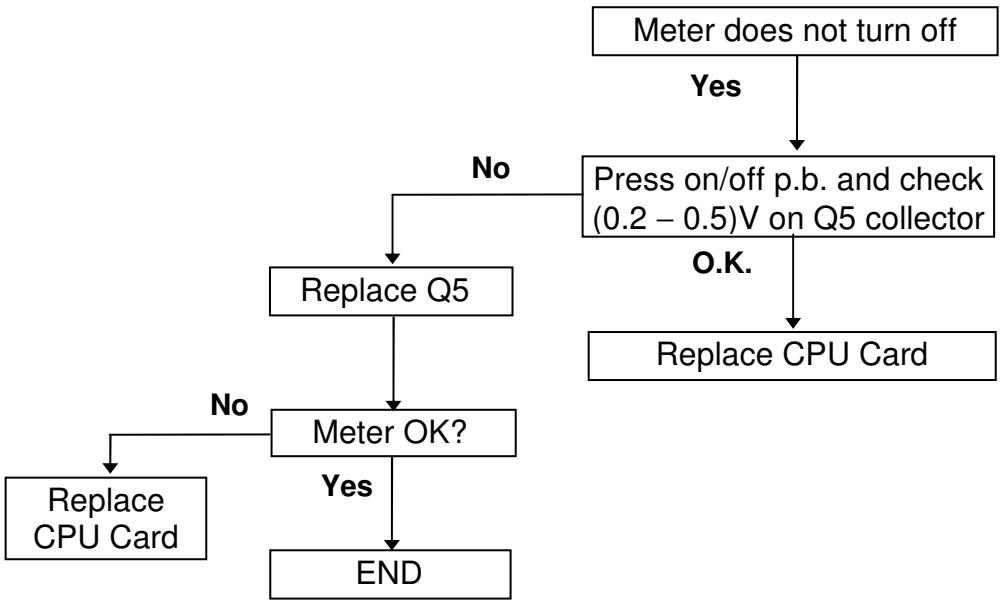
8.4. CPU reset circuit (PC 1944)



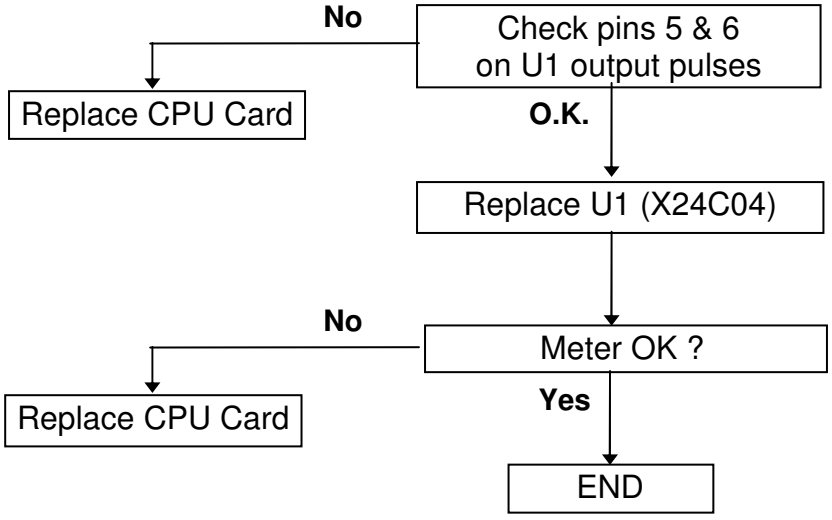
8.5. 12V power supply circuit (PC 1945)



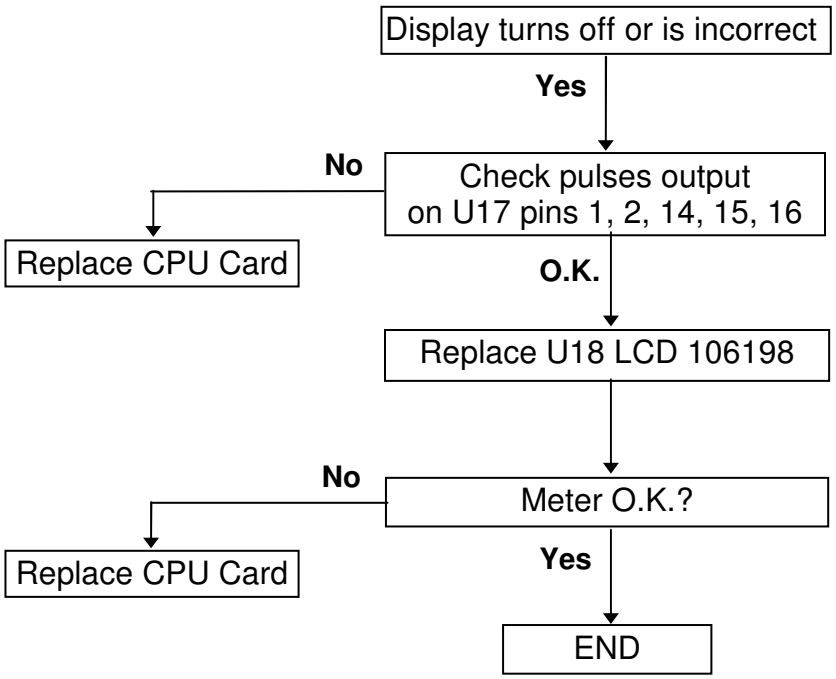
8.6. Meter does not turn off



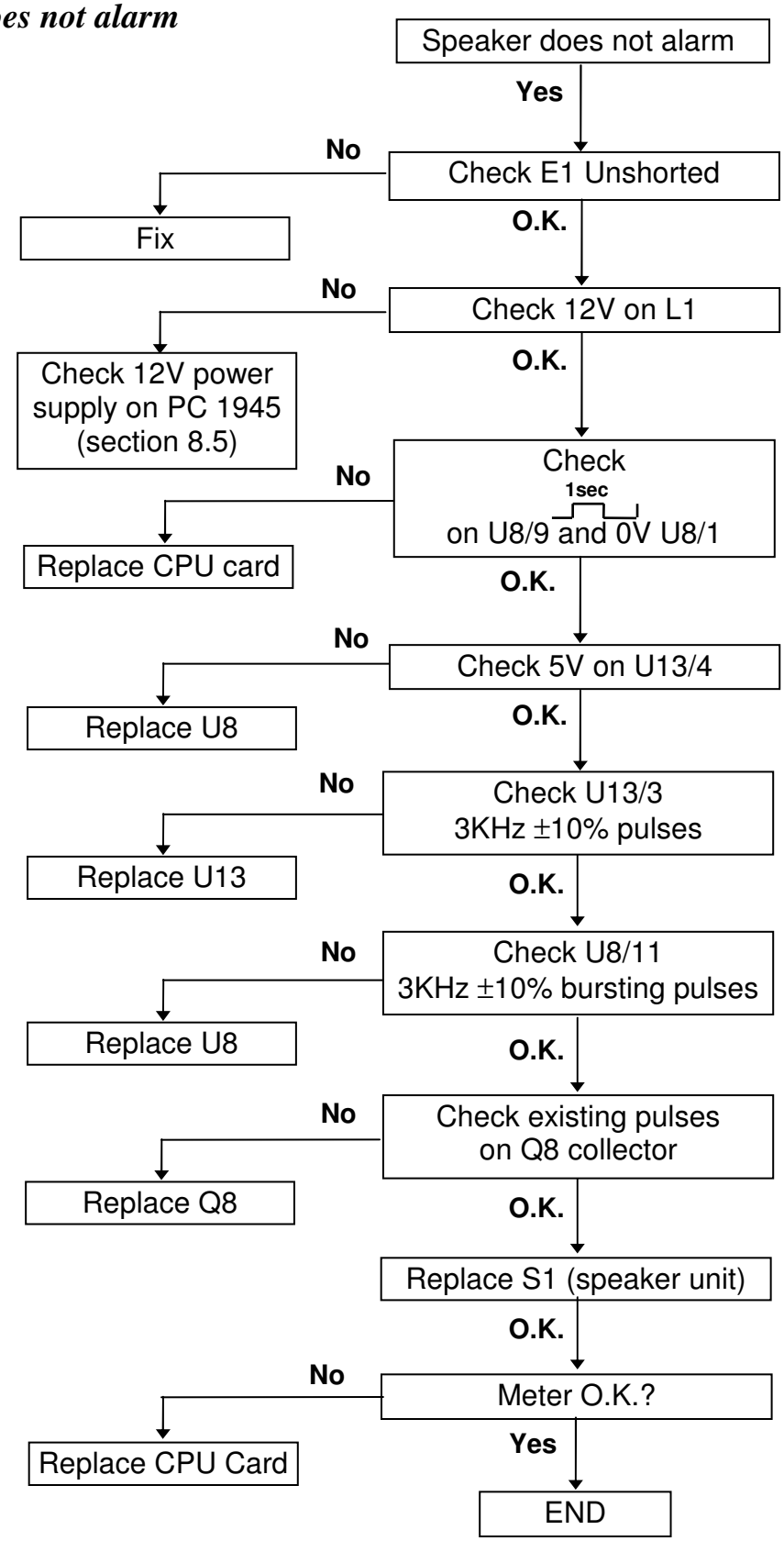
8.7. Meter parameters are not saved in the internal memory



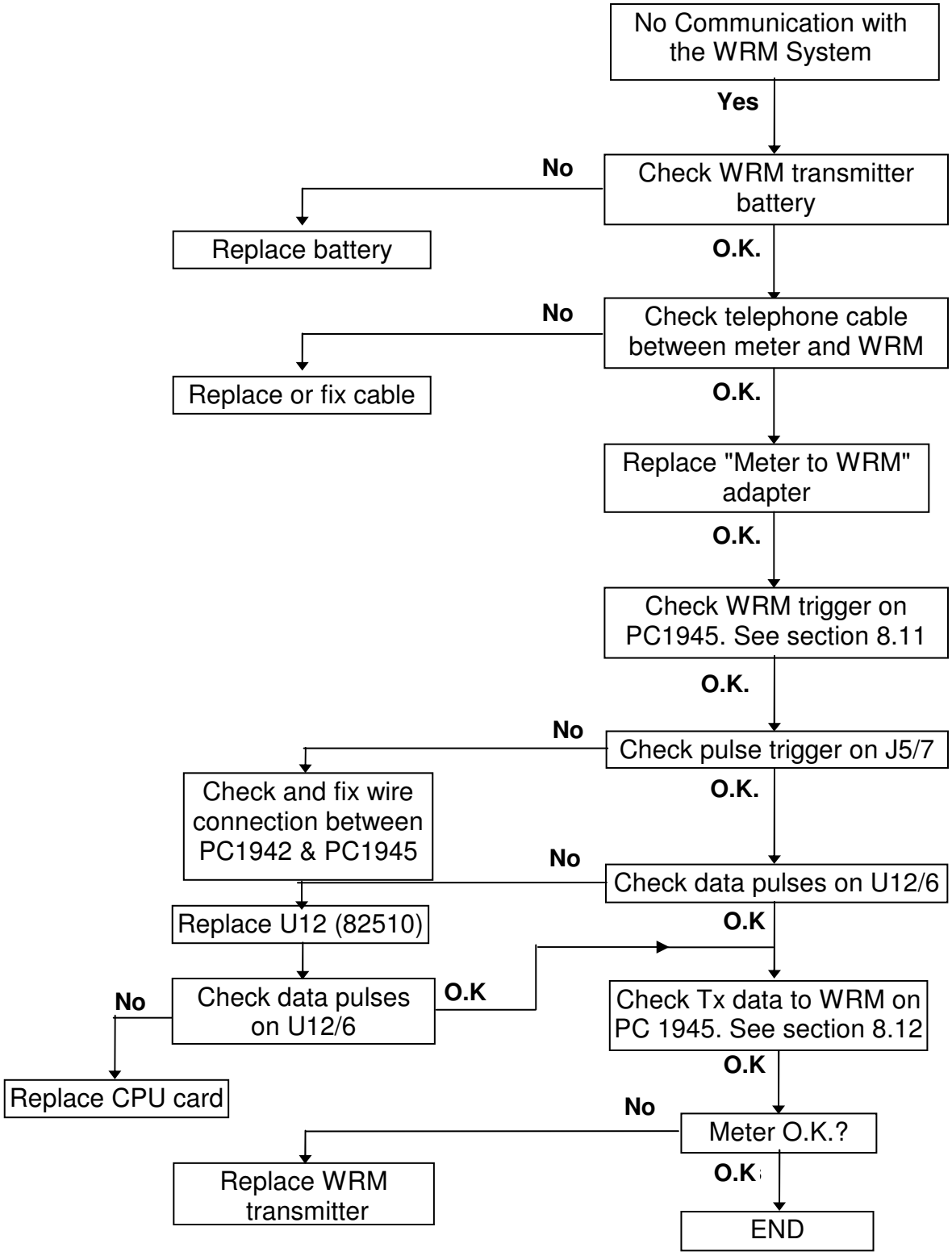
8.8. Display turns off or is incorrect



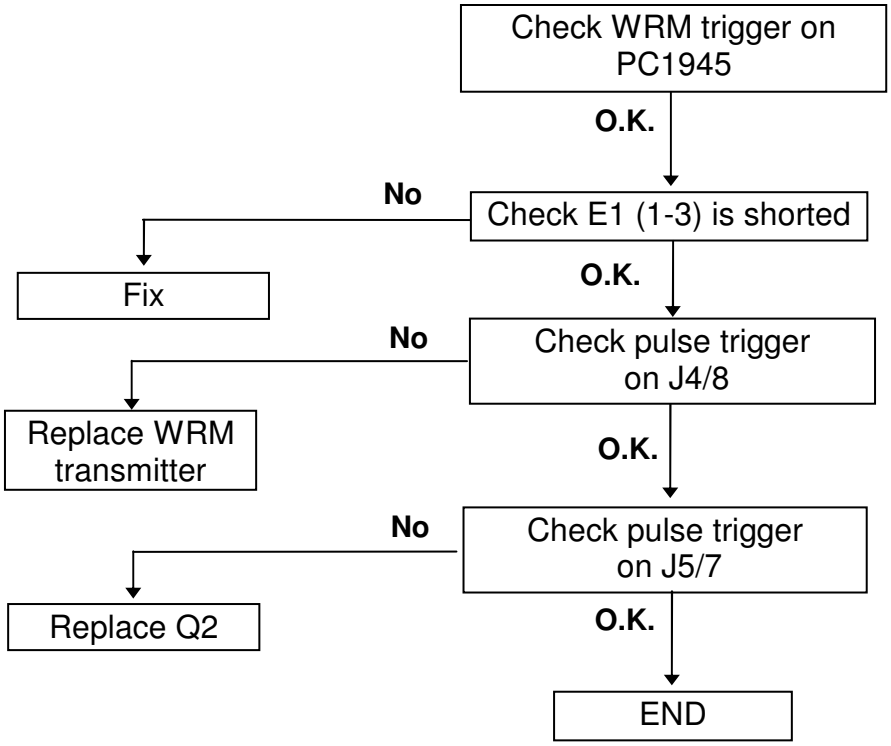
8.9. Speaker does not alarm



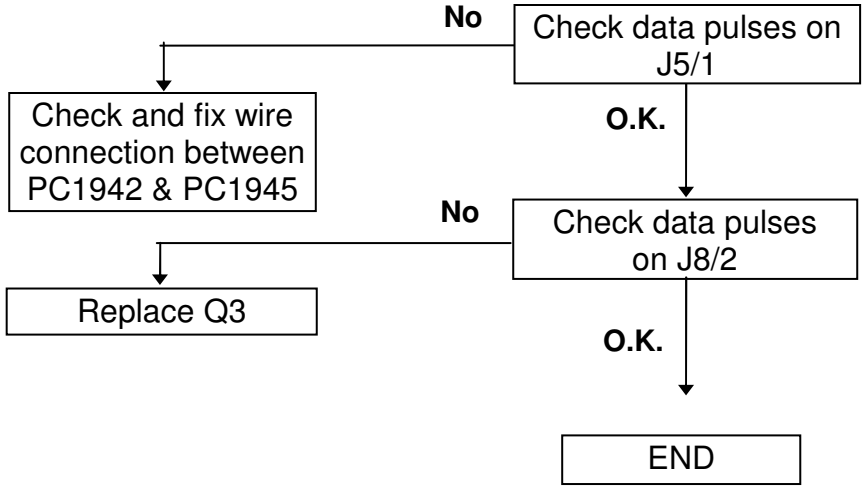
8.10. No communication with the WRM system



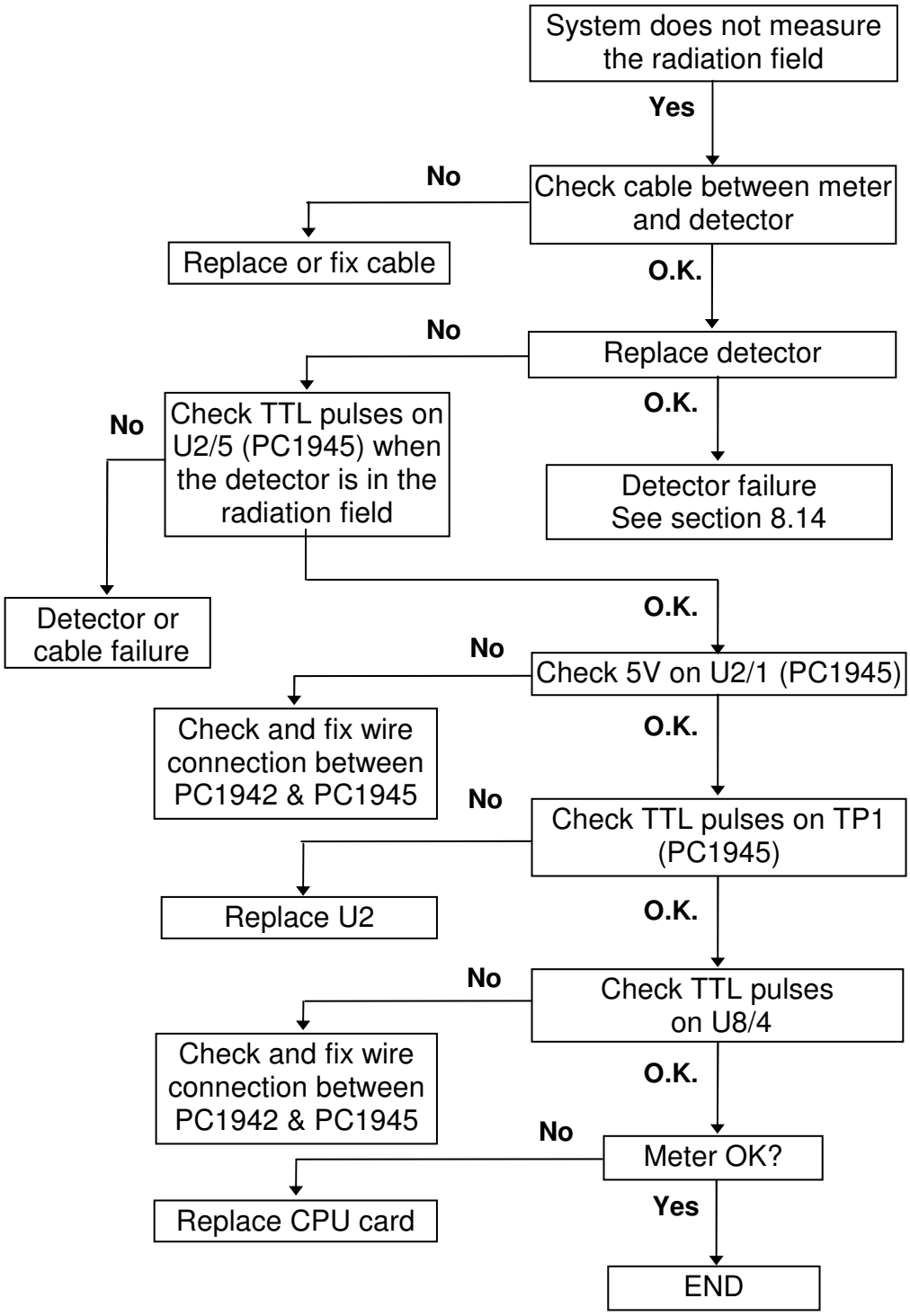
8.11. WRM trigger checking



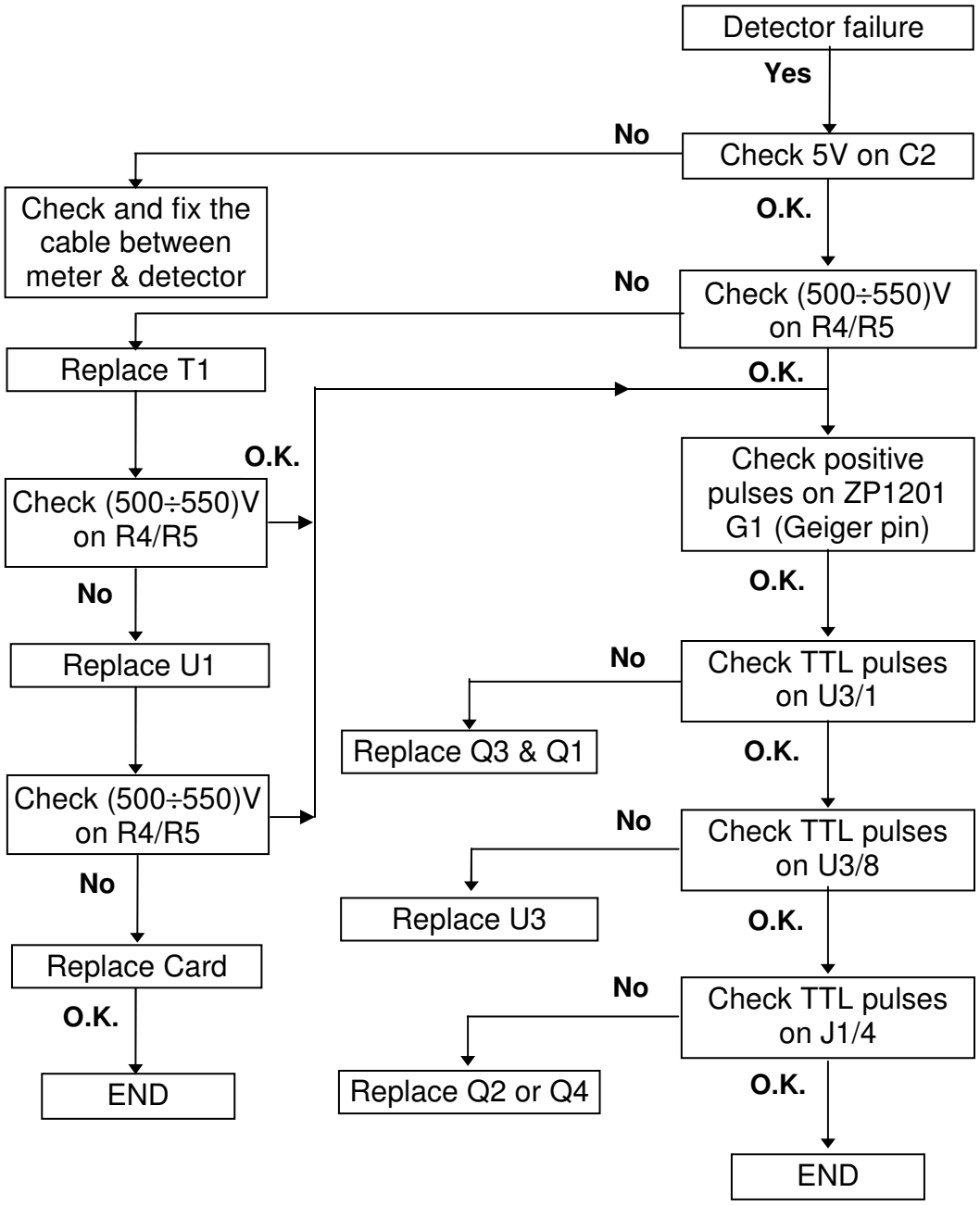
8.12. Check Tx Data to WRM on PC 1945



8.13. Instrument does not measure the radiation



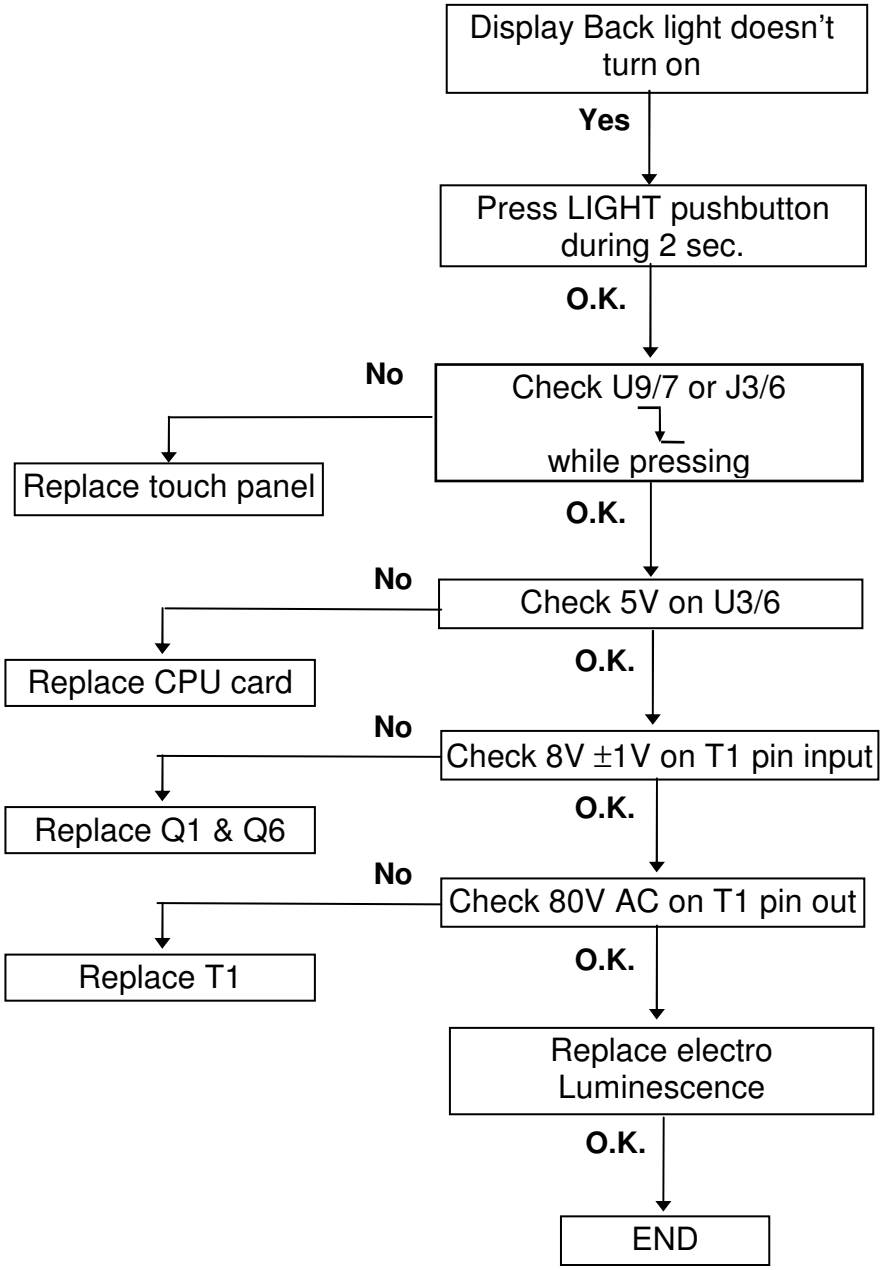
8.14. Detector failure (PC 2003)



The detector alarm is activated when:

- The detector high voltage power supply is defective.
- The detector is located in a background radiation field and the low range Geiger is defective. If the detector is located in a radiation field higher than 800mR/h, and the meter displays the following readings sequence: 800 mR/h, 600 mR/h, 0.00 mR/h - this indicates high range Geiger malfunction.

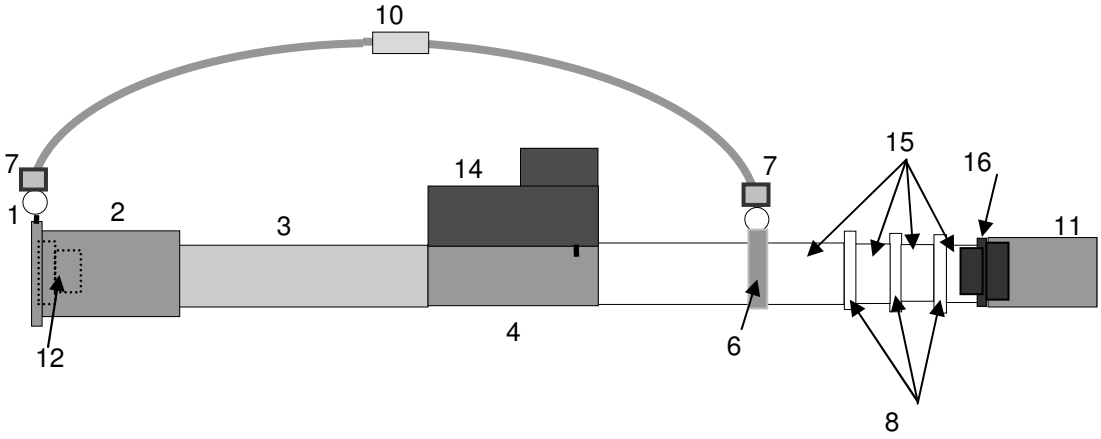
8.15. Display Back Light doesn't turn ON

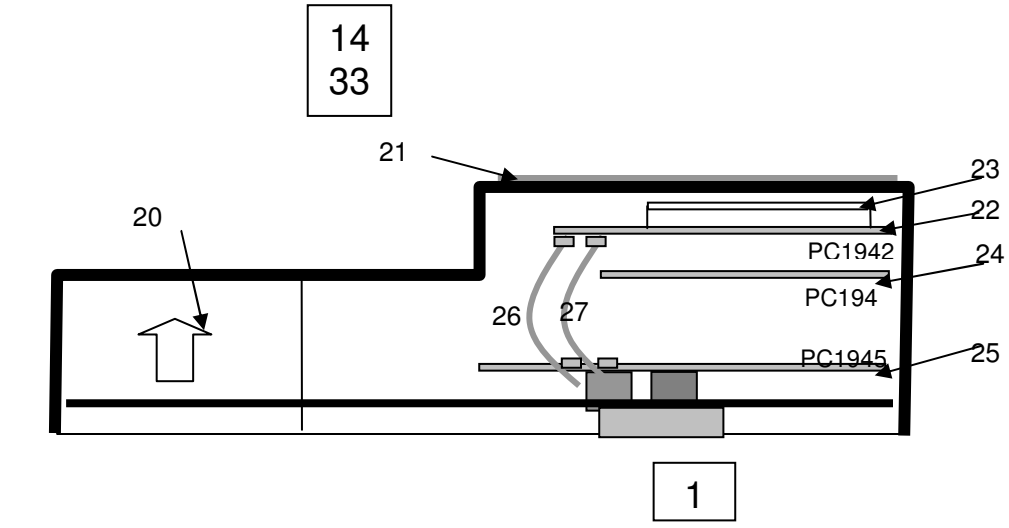


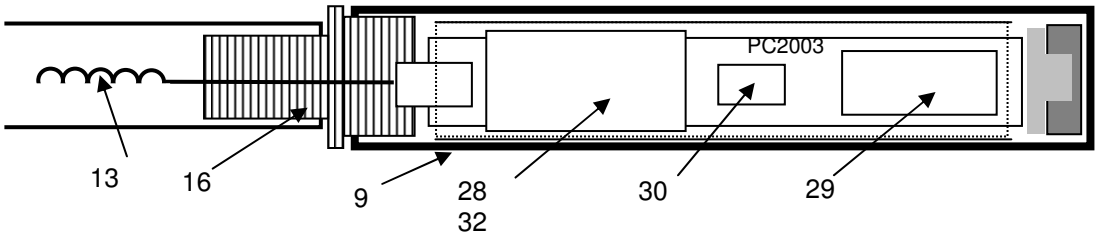
9. Mechanical Instructions

July 2007

9.1. TelePole WR meter exploded drawing and parts list







TelePole WR Part Numbers

P/N	Part Name	Part #
RTM-9113	Complete TelePole WR	
RTM-3010	Meter bracket & 4 screw	4
RTM-3017	Carrying strap	10
RTM-3013	2 strap clip	7
	Pole assembly	
RTM-3020	Complete pole assembly	
RTM-3014	4 Segment pole with fastening nuts	15
RTM-4037	Collar, aluminum (external) set of 3	8a,8b,8c
RTM-4036	Clutch, plastic (internal), set of 3	8a,8b,8c
RTM-3018	Rear lid (underneath grip)	12
RTM-3008	Grip	2
RTM-3007	Rear strap holder	1
RTM-3009	Heat shrinkable tube	3
RTM-3012	Front strap holder	6
RTM-3050	Pole to Detector adapter & 2 screw	16
RTM-3019	Telephone coiled cable 120 cm(internal)	13
	Meter assembly	
RTM-3046	Complete meter assembly	33
	Mechanical parts	
RTM-3011	Meter case complete without electronics boards	14
RTM-1023	Battery cover	20
	Electronic parts	
RTM-3045	Touch panel	21
RTM-3022	CPU board with LCD	22
RTM-3044	LCD display	23
RTM-3021	Memory board with EPROM	24
RTM-3023	Power supply board	25
RTM-3024	Flat cable 10p	26
RTM-3025	Flat cable 4p	27

	Detector assembly	
RTM-3049	Complete detector assembly	11
RTM-3048	Detector board 2003 with 2 Geiger, rear flange (and 2 screws), damping sponge and mica cover	28
RTM-7000	Detector board 2003 without Geiger	32
RTM-4022	Geiger1201	29
RTM-4035	Geiger1301	30
RTM-3051	Detector sleeve/cover & 3 screws	9

9.2. Preparation for Use

***Note:** See the telescopic pole construction scheme for reference.*

NOTE: The manufacturer recommends that the end user/owner to perform periodic inspections of the telescopic pole, collars, and clutches to ensure proper operational use and safety.

9.2.1. Check the condition of the segments, collars, and clutches (under collars) as follows: Hold the telescopic pole with both hands horizontally. Wear the carrying strap (15) over the head and on the shoulder, one hand holding the pole and the other hand free to adjust the strap to the optimal length. See Figure 7-1.

Figure 7-1. Telescopic pole holding

9.2.2. Check the segments' fastening/collar nuts (8: a, b, c) by turning them slightly, to make sure there are no disturbances or wore clutches.

9.2.3. Check the pole segments (9, 10, 11, 12) by extending them all the way out, following the proceeding steps:

9.2.4. Ensure the three fastening nuts (8: a, b, c) are locked.

9.2.5. Loosen nut (8c) by turning it counter-clockwise (looking from the meter side).

9.2.6. Pull segment (12) all the way out.

9.2.7. Tighten nut (8c).

9.2.8. Loosen nut (8b).

9.2.9. Pull segment (11) all the way out.

9.2.10. Tighten the middle nut (8b).

9.2.11. Loosen nut (8a).

9.2.12. Pull segment (10) all the way out.

9.2.13. Tighten nut (8a)

9.2.14. Ensure that proper tension is on each collar in order for the segments to stay in one position when moving the instrument up and down and side to side with the segments completed extended.

9.2.15. Now collapse each segment back inwards in the reverse order.

9.3. Detector disassembly (14)

9.3.1. Loosen the three NC 4-40x3/8 Philips flat screws located at the bottom of the detector (14).

9.3.2. Gently pull the detector (14) about two cm out with one hand. Hold the detector cable with the other hand and continue drawing the detector tube out until the connector is visible. Press the connector's plastic clip to disconnect the cable from the detector. Hold the cable end with a clip to prevent it from entering back into the pole.

9.3.3.

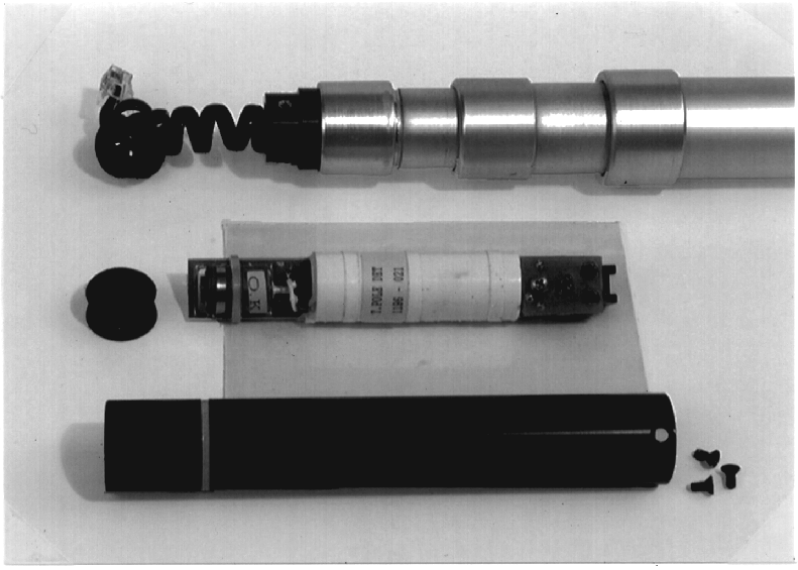


Figure 7-2. Detector disassembly

9.4. Meter disassembly (4, 5)

9.4.1. Disconnect the detector phone cable connector from the meter rear panel by pressing the plastic clip.

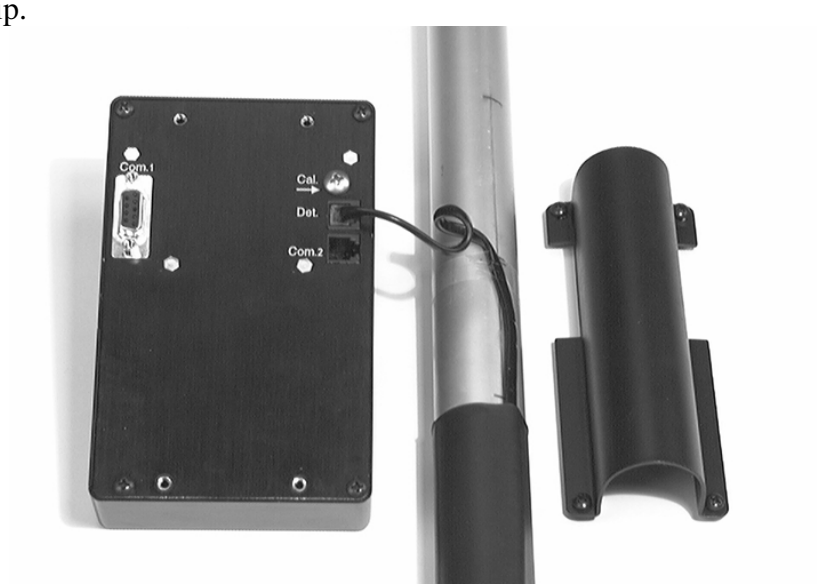


Figure 7-3. Meter disassembly

9.4.2. Loosen the four NC 6-60 Philips screws fastening the meter holder (4) to the meter.

9.4.3. The meter and holder are now detached from the telescopic pole. See Figure 7-3.

9.5. Meter Holder Assembly (4)

9.5.1. Position the meter (5) on a flat and clean surface with the display facing down.

9.5.2. Position the telescopic pole on the meter rear cover.

9.5.3. Position the meter holder (4) on the meter (5) while the cable groove is facing the telephone socket side.

9.5.4. Ensure the cable goes through the inside space created between the meter holder and the meter rear cover.

9.5.5. Attach the meter holder (4) to the heat shrinkable tube (3) and tighten the four screws.

9.6. Detector Assembly (14)

9.6.1. Connect the cable to the detector. Insert the detector (14) back into the pole's end.

9.6.2. Tighten the three NC 4-40 x 3/8 Philips flat screws located on the detector bottom part (14), use lock tight material to secure the screws.

9.7. Pole Segments Assembly

9.7.1. Insert the segments (9, 10, 11, 12) one into the other according to their diameter size, from the largest to the smallest one, while the threads are facing forward in the detector direction.

9.7.2. Insert plastic rings into the two biggest fastening nuts (8a, 8b).

9.7.3. Screw the two fastening nuts (8a, 8b) on the segments (9, 10), in order of their size (first the bigger nut 8a), and then fasten them.

9.7.4. Insert the smallest plastic ring on the last segment (12), push the ring backwards, next to the thread of segment (11).

9.7.5. Insert the third nut (8c) and screw it on segment (11).

9.8. Pole Segments Disassembly

9.8.1. Perform the steps in section 7.7 in the reverse order.

9.9. Telescopic Pole Troubleshooting Table

Symptom	Probable Cause	Required Action
Segments are stuck and the pole doesn't extend	Superficial damage, crushed, (squeeze) segments and / or adjusting nuts.	Visually inspect segments and/or nuts for external damages. Replace damaged parts.
	Cable is caught inside the segments.	Shake the pole up and down to release the cable.
	Sand or chips of dirt caught inside, between the segments.	Remove any foreign debris from the sections.
After extending out the segments, they cannot be retrieved back.	Squeezing or bending of the segments and/or adjusting nuts.	Replace telescopic pole.
	Fastening nuts are stuck.	Loosen the nut and remove it to inspect visually. If the plastic ring underneath is damaged, replace it.
	Cable is caught inside the pole.	Disassemble the detector. Disconnect the cable and pull it in and out several times to release it, at the same time, extend and collapse the segments several times.
Cable damage.	Instrument stored with the telescopic pole extended for a long period. Cable loses flexibility.	Store the instrument with the telescopic pole collapsed.

Appendix 1

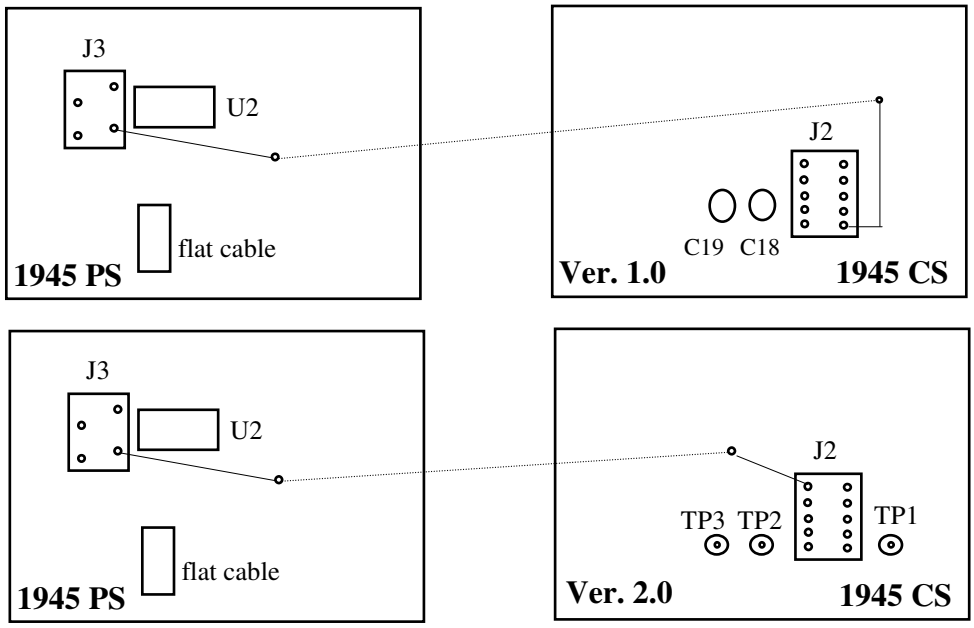
Upgrading TelePole Instruments from High Range and Low Range to Wide Range

1. WR Detector

- Replacing the detector with a new wide range detector.
- Pull gently the detector about two cm out with one hand. Hold the detector cable with the other hand and continue drawing the detector tube out until the connector is visible. Press the connector plastic clip to disconnect the cable from the detector. Hold the cable end with a clip to prevent its entering back into the detector tube.

2. Power Supply Board - PC #1945

- Loosen the four screws adjusting the PC board.
- Disconnect all the flat cables.
- Remove the PC board.
- Short J2/2 (on the print side) to J3/3 (on the component side) with the supplied wire as depicted in the drawing below.



- Place back the PC board, tighten with the four screws.
- Reconnect the flat cables.

3. Memory Extension Card - PC #1944 Ver. 2.0 or 2.1 and CPU Board - PC #1942 Ver. 2.0 or 2.1)

- Insert EPROM 27C512 on U1.
- Short pins 1 and 2 (instead of pins 2 and 3) on E3.

4. CPU Board - PC #1942 Ver. 1.0

- Replace the memory extension card with a modified one.

5. Set the five new calibration factors values according to the calibration certificate.

Appendix 2

Generic TelePole Calibration

1. It is possible to set/change **all** the factors **outside** the radiation chamber.
2. When the radiation field is **lower than 10 mR/h**, it is possible to change **all** the factors.
3. When in the calibration mode and the external radiation field is lower than 10 mR/h, pressing the MODE push-button can switch between the different factors.
4. Suggested procedure:

   4.1 Turn the internal switch to the calibration position.

   4.2 Press the MODE push-button twice to enter the calibration mode.

   4.3 Expose the TelePole to a radiation field of 50 mR/h ±20mR/h. The meter will be automatically set to factor F1. Now the factor can be changed either by pressing the RESET or LIGHT push-button or taking the meter outside the radiation chamber and adjust the factor F1.
   Place the TelePole back inside the radiation chamber and expose it to a radiation field of 50 mR/h. Check that the meter's reading and the radiation field are equal.

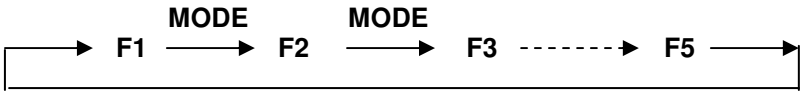
   4.4 Expose the TelePole to a radiation field of 350 mR/h ±50mR/h. The meter will be automatically set to factor F2. Now the factor can be changed either by pressing the RESET or LIGHT push-button or taking the meter outside the radiation chamber, the radiation field should be lower than 10 mR/h. Notice if the current displayed radiation factor is F2. If the factor is not F2 press the MODE push-button to switch to F2. Adjust F2 by pressing the RESET or LIGHT push-button.
   Place the TelePole back inside the radiation chamber and expose it to a radiation field of 350 mR/h. Check that the meter's reading and the radiation field are equal.

   4.5 Expose the TelePole to a radiation field of 10 R/h ±2 R/h. The meter will be automatically set to factor F3. Now the factor can be changed either by pressing the RESET or LIGHT push-button or taking the meter outside the radiation chamber, the radiation field should be lower than 10 mR/h. Notice if the current displayed radiation factor is F3. If the factor is not F3 press the MODE push-button to switch to F3. Adjust F3 by pressing the RESET or LIGHT push-button.
   Place the TelePole back inside the radiation chamber and expose it to a radiation field of 10 R/h. Check that the meter's reading and the radiation field are equal.

   4.6 Expose the TelePole to a radiation field of 350 R/h ±50 R/h. The meter will be automatically set to factor F4. Now the factor can be changed either by pressing the RESET or LIGHT push-button or taking the meter outside the radiation chamber, the radiation field shold be lower than 10 mR/h. Notice if the current displayed radiation factor is F4. If the factor is not F4 press the MODE push-button to switch to F4. Adjust F4 by pressing the RESET or LIGHT push-button.
   Place the TelePole back inside the radiation chamber and expose it to a radiation field of 350 R/h. Check that the meter's reading and the radiation field are equal.

4.7 Expose the TelePole to a radiation field of 600 R/h ±100 R/h. The meter will be automatically set to factor F5. Now the factor can be changed either by pressing the RESET or LIGHT push-button, or taking the meter outside the radiation chamber, the radiation field should be lower than 10 mR/h. Notice if the current displayed radiation factor is F5. If the factor is not F5 press the MODE push-button to switch to F5. Adjust F5 by pressing the RESET or LIGHT push-button.
Place the TelePole back inside the radiation chamber and expose it to a radiation field of 600 R/h. Check that the meter's reading and the radiation field are equal.

5. When adjusting F2, F3, F4, F5, and the TelePole is taken out of the radiation chamber, it can either remain at the current factor or switch back to F1, depends on the radiation field falling speed. If the meter switches to F1, press the MODE push-button to switch to the current factor, each press will precede the factor to the next factor.



Appendix 3

Rotem Meter View Software (RMV)

Preface

Rotem **M**eter **V**iew Software (RMV) is a WINDOWS 95 based program, aimed to download ROTEM's meters measurements to a PC. The meters are: RAM ION, TelePole and RAM DA-2000. Communication between the meter and the PC can be performed in two modes:
On-Line - The meter downloads the measured data into the PC at intervals time set by the user.
Off-Line - Data is stored in the meter (up to 347 strings) and then downloaded into the PC.

Required Equipment

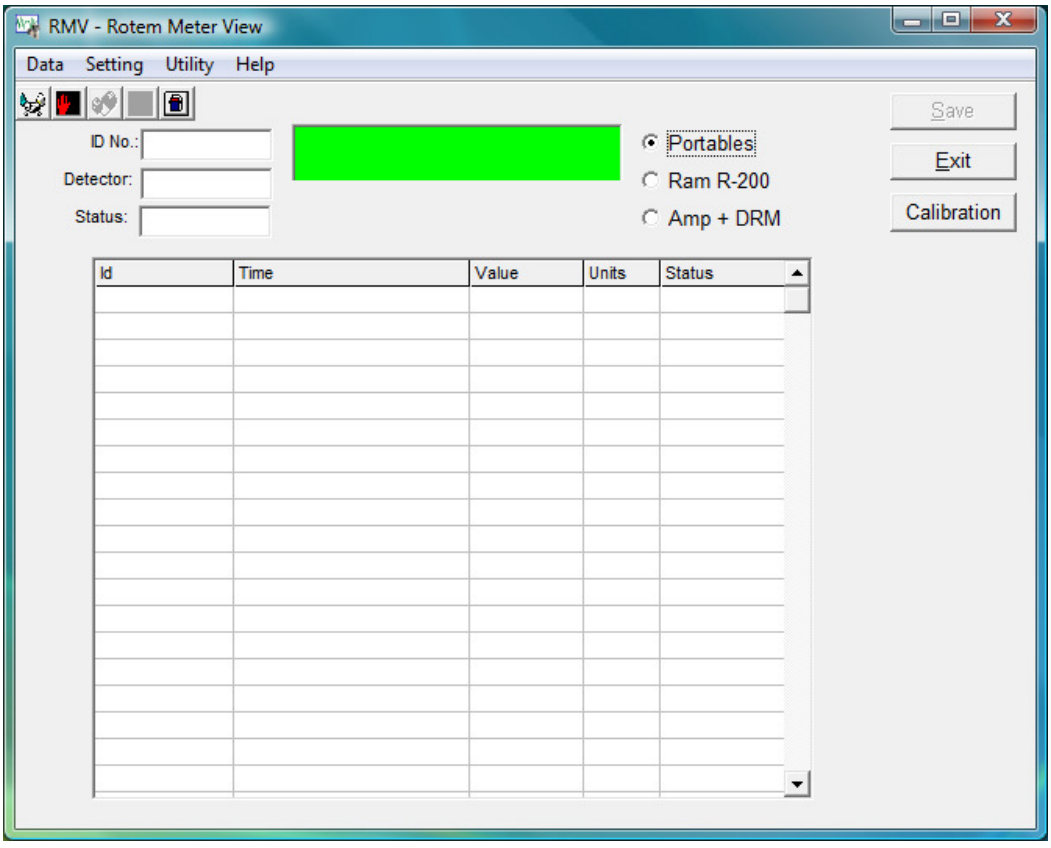
PC based WINDOWS 2000/XP/Vista and RS-232 communication port.
MGPI's customized communication cable.
Download Meter View from the MGP Instruments web site www.syodys.com .

Software Installation

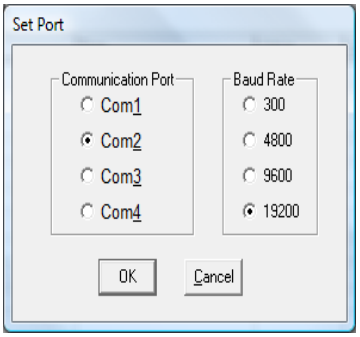
Insert the CD into the CD drive (or the first floppy diskette into the floppy drive). Select Start, then run and select the setup.exe file.

Operating Instructions

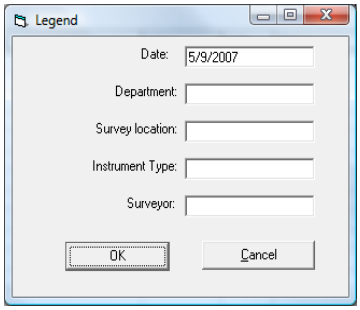
1. Connect one of ROTEM's meters to the PC via RS-232 communication port, by the customized communication cable.
2. Start the Meter View software.



3. Select ‘Setting’ to set the Communication Port.



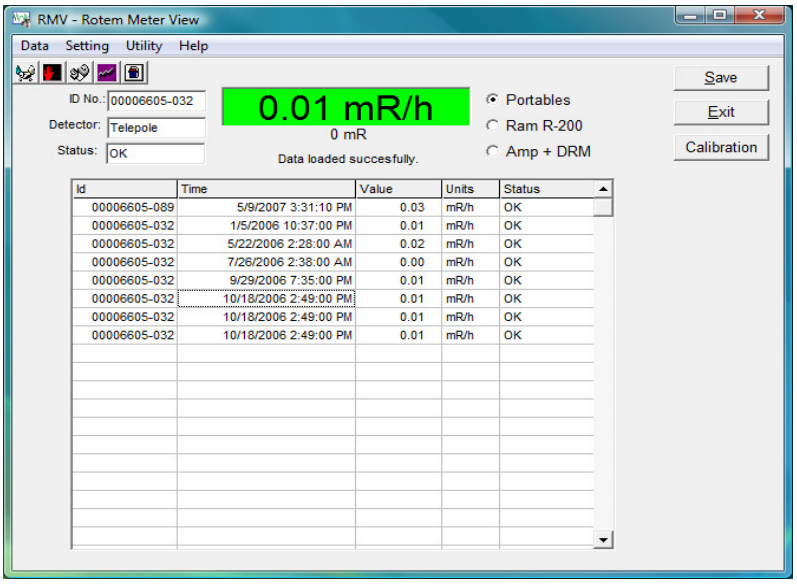
4. Select Get legend to fill the legend parameters.



Data Download to PC

Off Line

1. Store the ID location in the meter by a short press on the SPEAKER push-button.
2. Store the measurements and date in the meter by a short press on the LIGHT push-button.
3. Select ‘Data’ “Get offline data’ to download the meter's data.



In the displayed table notice that:
When an asterisk (*) appears on the **Over Thr.** column, it indicates a reading higher than threshold setting.
The **Status** column indicates threshold or failure alarms.

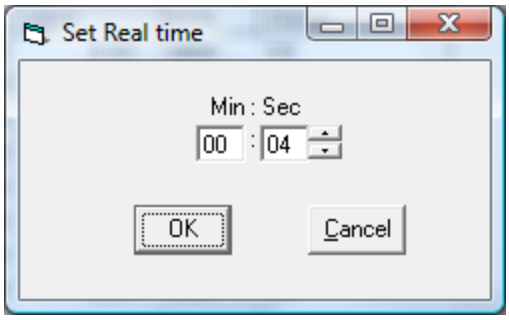
Bytes status description:

		32	16	8	4	2	1
		OFLO dose	OFLO rate	Over thr. rate	Over thr. dose	Detector fail	Low battery

For example:
Status = 1 - low battery
Status = 8 - over threshold rate.
Status = 9 - low battery and over threshold rate.

On-Line

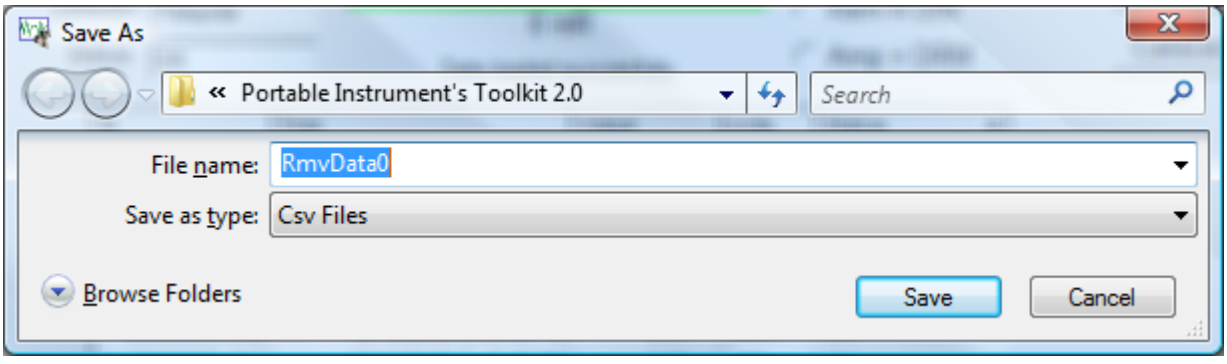
1. Select '**Set Interval'** for WRM2 Radio.



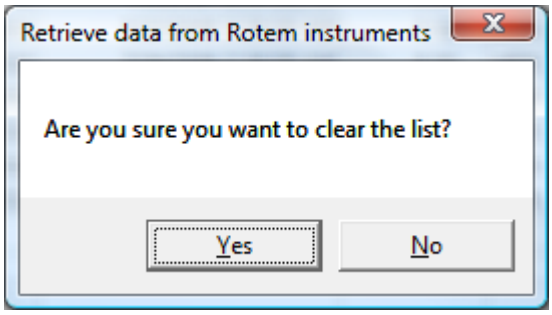
2. Select **Start**, the meter downloads the data into the PC at intervals time set by the user. The **Start** icon is replaced by the **Stop** icon.
   Note: When software is in the on-line mode, the **Get Data** icon is blocked since it belongs to the **off-line** mode.
3. To exit of the **on-line** mode select the **Stop** icon (green color). The **Start** icon (orange color) is displayed on the Meter View window.

General Functions

1. To save the data file select the **Save** icon and type the **File Name**. The saved data file can be opened using MS NotePad or Spreadsheet software.



2. Select the **Clear** icon to clear the screen after saving the file.



3. To set the correct time and date to the TelePole select ‘Utility’ and then Send Time.

Appendix 4

TelePole WR - List of Electronic Drawings

Available Upon Request

DRW #12850-40-00 - Ver. 2.1 - CPU - DigiLog (sheet 1), PC #1942

DRW #12850-40-00 - Ver. 2.1 - CPU - DigiLog Display (sheet 2), PC #1942

DRW #12850-41-00 - Ver. 2.1 - CPU - DigiLog Extension Card, PC #1944

DRW #12850-42-00 - Ver. 4.0 - Power Supply, PC #1945

DRW #12852-40-00 - Ver. 2.0 - GM Detector, PC #2003

DRW #12852-50-00 - Ver. 2.0 - Wiring Diagram

DRW #12850-45-00 - Ver. 2.0 – CPU – Digilog Display