AMP

Area Monitor Probes

AMP 50-100-200

Operation and Maintenance Manual

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MGP INSTRUMENTS
synOdys Group

Revision Log

Revision #	Date	Revised Pages	Comments
0	July 2002	N/A	Area Monitor Probes, Operating & Maintenance Manual. Document # PRIR91J2.DOC This AMP comprehensive issue is based on the following documents: AMP-100 – PRIR32J8.DOC, Ver 5.0 AMP-200 – PRIR55J9.DOC, Ver 1.1 AMP-50 – PRIR89J1.DOC, Ver 1.0 Reformat document.
1	Sept 2003	N/A	Revised AMPView software screenshots for update Reformat document
2	June 2004	7, 29 ,30	Added baud settings when using WRM and WRM2 transmitters and new serial number with meter type codes.
3	Oct 2005	All	Removed AMPView software and added Meter View software section 8. Corrected typographic errors and formatting
		Page.18	Add information for WRM2 EXT Transceiver.
4	Jan 2006	Page 11	New EPROM version for displaying Threshold Setting at start-up (new release of firmware)
		Pages 16 and 35	Corrected/Added connection type for the PC communications, supplied connector RTM-9128
5	April 2006	Pages 11 and 36	Added new version of firmware for displaying Threshold Rate on startup, Clarified baud rate setting when connecting RMV

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1. Area Monitor Probes

1.1. General Description

The Area Monitor Probe (AMP), a GM-tube based gamma rate meter, is a state-of-the-art microprocessor-based instrument. The AMP is designed for highly stable and accurate measurements of dose rate from gamma and x-ray radiation.

The AMP instrument is available in three versions:

- AMP-50 - Covers a measuring range of 0.05 mR/h up to 4000 mR/h.
- AMP-100 - Covers a measuring range of 0.005 R/h up to 1000 R/h.
- AMP-200 - Covers a measuring range of 1.0 R/h up to 10,000 R/h.

The AMP is a lightweight and compact instrument with a four large, 7-segment LCD display. An EPROM based software offers special features and optimal performance. The wide dynamic range is obtained by automatic dead time correction, according to the preset calibration. A special averaging function smoothes the readout and maintains fast response time, while keeping the standard deviation at a minimum.

An automatic self-diagnostic procedure continuously checks both meter and detector and reports any case of detector failure. The meter also alarms if the reading exceeds a user defined threshold value, or if the probe is in a field higher than the measuring range, or if the battery voltage drops below an acceptable value. The threshold can be selected from a list of 11 preset values or user inputted using the Meter View configuration software. When the meter is turned off the last parameters (threshold value, calibration factor, dose status, communication mode, communication baud rate) are retained in memory and will be recalled the next time the instrument is turned on.

The AMP may be used in one of four ways:

- by locally reading the smoothed digital display via the hand held meter display,
- by connecting the meter to a PC,
- by connecting the meter to aa DDC-16/AM-16 Area Monitor (wired),
- by connecting the meter to an external WRM transmitter (wireless).

The AMP system contains four components (see Figure 1-1, AMP system block diagram): meter, cable, probe head and communication interface. Connection between the meter and the detector is accomplished via a four-wire shielded cable of up to 100 meters in length. An optional WRM transmitter may be connected via a standard four-wire telephone cable. Two types of meter-to-PC cables are available.

The meter includes two boards: HV board and CPU board, including rate-meter and display. A built-in RS-232 connection is used with the area monitor or WRM.

The detector includes an energy compensated GM tube, an amplifier and driver.

The AMP's connections and probe head feature watertight sealing to allow for use in underwater applications. Quick disconnect detectors allow customization of cable length and facilitate easy de-contamination.

1.2. Applications

- Real time monitor applications include any area with radiation levels from 0.05 mR/h up to 15,000 R/h. For example, the probe head may be placed *directly onto* a filter housing or against a resin tank for the purpose of providing survey data or resin transfer results.
- Replacement of traditionally "difficult to calibrate" underwater instruments.
- Provides a rugged detector for environments where the use of an electronic dosimeter is undesirable.
- Provides real-time, remote monitoring in geometries developed for extendible "pole" rate meters (TelePole, Ram Ion, etc.).
- Local readout of hand-held meter allows its use as a portable survey instrument.

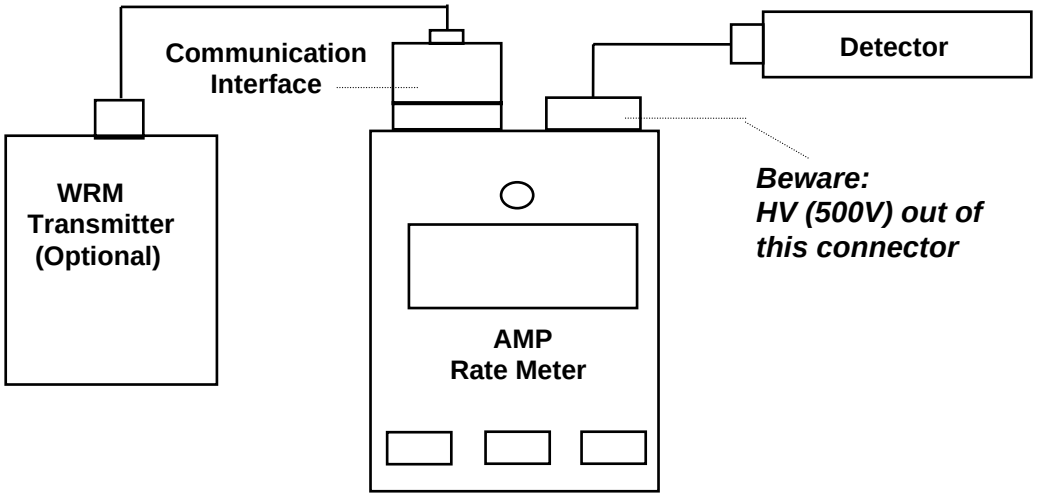


Figure 1-1. The AMP System Block Diagram

1.3. AMP Communication

1.3.1. AMP to WRM Communication (300 baud)

WRM – MGP Wireless Remote Monitoring System

The AMP's meter may be connected to an external WRM 91 transmitter through a supplied male DB-9 pin to RJ-22 adapter. In this mode, the AMP's meter transmits its reading data using the same data format as a dosimeter. Data is displayed on the computer screen, as appropriate for the application (i.e. TeleMap, TeleView, TeleView 2000, etc.). The serial number provides information about the instrument type.

Note:

When the AMP's are used with telemetry ensure that the proper parameters are set before the units are in operational mode in the field. The parameters for settings for WRM telemetry are 'TRIG' mode and a baud rate of '300' when using the WRM transmitters. The baud rate parameter for the transmitters must also to be set to '300'.

1.3.2. AMP to WRM2 or PC Communication

The AMP's meter may be connected to a PC via an external cable with the special nine pin connector attached to the AMP that is provided with the device. In this mode, the AMP's meter transmits its reading data using the WRM format. Data is displayed on the computer screen, as appropriate for the application (i.e.AMP-View). The parameter settings for the PC and WRM2 communications need to be set to 'Aut" and a baud rate of "9600".

Note:

Ensure that the PC and WRM2 transmitter's baud rates are set the same baud rate as the AMP, i.e. '9600' baud rate and that are switches in the back inside of the WRM2 EXT Transceiver are set to RS-232 and Data output (all switches should be in the "left" position).

1.3.3. AMP Identification Number

Each AMP has a different identification number (ID#) consisting of six digits. When the first ID# digit is (9), it indicates the monitoring software that the transmitting instrument is a portable instrument and the second digital indicates what type of instrument, i.e. AMP-50, AMP-100, AMP-200, TelePole, Ram Ion, or DRM. The last 3 digits represent the instrument serial number. See section 7.2 page 29.

2. Specifications

Display		LCD readout showing: - Four digits for accurate and easy readout - Detector failure - Low battery - Overflow - Threshold
Audio		Internally mounted piezo-electric element (used for alarm and "chirp" functions)
Measuring unit	**AMP-50** **AMP-100/200**	[mR/h] [R/h]
Measuring range	**AMP-50** **AMP-100** **AMP-200**	0.05 mR/h to 4000 mR/h 0.005 R/h to 1000 R/h 1.0 R/h to 10,000 R/h
Display range	**AMP-50** **AMP-100** **AMP-200**	0.001 mR/h to 4000 mR/h 0.001 R/h to 1000 R/h 0.1 R/h to 15,000 R/h
Controls		- ON/OFF push-button - RESET push-button - SPEAKER push-button
Power source		One 9-volt cell battery or external 9V power supply - 50 hours minimum continuous operation, using an alkaline battery (speaker off) - Automatic battery check under full load
Detector	**AMP-50** **AMP-100** **AMP-200**	Energy compensated GM tube (ZP1201 or equivalent) Energy compensated GM tube (ZP1301 or equivalent) Energy compensated GM tube (4G60M or equivalent)
Sensitivity (^{137}Cs)	**AMP-50** **AMP-100** **AMP-200**	17 cps/mR/h 300 cps/R/h 77 cps/R/h
Accuracy		±10% of reading within the measuring range

Energy range			70 keV to 2.0 MeV
Energy dependence			±20% related to ^{137}Cs
Angular dependence			Less than ±20% for 45° from centerline indicator on the probe housing
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			40% to 95% RH (non condensing)
Casing	**Meter:**		Aluminum
	Detector:		Aluminum, waterproof to 20 meters
Dimensions	**Meter:**		12 cm x 7.2 cm x 3.4 cm (4.72" x 2.83" x 1.34")
	Detector:		
		AMP-50	3.3 cm x 17 cm (1.3" x 6.7") without cable
		AMP-100/200	2.45 cm x 14.3 cm (0.96" x 5.71") without cable
Weight	**Meter:**		340 g (0.76 lbs) including battery
	Detector:		
		AMP-50	223 g (0.45 lbs) without cable
		AMP-100/200	131 g (0.29 lbs) without cable
Cable length			Standard: 25 feet Maximum: 350 feet
Part #		**AMP-50**	**RTM-A007**
		AMP-100	**RTM-A004**
		AMP-200	**RTM-A005**

3. Operating Instructions

3.1. Preparation for Use

Remove the instrument from the shipping container and check for physical damage. In case of damage, report it immediately to the carrier.

Note: Do not attempt to install or operate damaged equipment since safety and performance may be affected

3.2. Starting-up

Before connecting the detector cable to the detector side, perform the following:

1. Clean the cable connector from any dust, using air blast and alcohol.
2. Spread a thick layer of silicone grease on the o-ring.
3. Connect the cable connector to the detector connector.

Ensure the detector connection to the meter. **CAUTION:** Beware the HIGH VOLTAGE (500 Volts) on the meter's connector (see Figure 1-1).
Press the ON/OFF push-button. 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 a beep for a short period. Following the test, the meter is ready for use.

3.3. General Functions

***Readout*:** The meter utilizes an auto-ranging display.

AMP-50 [mR/h]	AMP-100 [R/h]	AMP-200 [R/h]
0.001 - 0.999	0.001 - 9.999	0.1 - 9.9
1.00 - 9.99	10.00 - 99.99	10.0 – 99.9
10.0 - 99.9	100.0 - 999.9	100 - 999
100 - 999		1000 - 9999
1000 - 3999		10.0E – 15.0E (10,000-15,000)

***Reading reset*:** To reset the reading press the RESET push-button. The reset function provides a rapid means of "zeroing" the display reading and enables accurate measurement of low level count rate.

***Audible alarm*:** In the case of threshold alarm or instrument failure, the audible alarm is activated. To mute the audible alarm, press the SPEAKER push-button.

3.4. Turning the Meter on

When turning the meter on the following parameters are displayed as an example:

1. EPROM version: **Epr. → 020- → -305 (060105)**
2. Threshold setting*: **Thr. → 1.0 (1.0 R/h)**

*AMP 100 EPROM version 060105, January 2006

3. Unit I.D. # **Id. → 945 → -123 (945123)**
4. Dose status **d-0** (dose function disabled) **d-1** (dose function enabled)
5. Communication mode **tri** or **Au: 04** or **Au: 10 Au: 30 Au: 60**
6. Meter baud rate **300, 4800, 9600**

3.5. Dose Status

3.5.1. The user can choose between two operating modes**:**

a. Display dose value enable and transmission to WRM connection (d-1)
b. Display dose value disable and transmission of 888888.8 to the WRM instead of the dose value (d-0).

The dose value is calculated since the meter is turned-on even if the dose display and transmission are disabled

3.5.2. On turning the meter on the accumulated dose is automatically reset to zero if the dose function is enabled**.**

3.5.3. To display dose value, press SPEAKER and RESET push-buttons simultaneously. The dose value is displayed and blinks for 10 seconds; afterwards, the meter turns back to display the rate value. To zero the dose rate value, press the RESET push-button during dose display.

3.5.4. Dose display and transmission enable/disable selection. (See flowchart in section 3.9.)

3.5.5. Dose display range**:**

- **AMP-50** 0.001 mR to 999 R
- **AMP-100** 0.001 R to 999 R
- **AMP-200** 0.1 R to 999 R

3.5.6. The dose mode **d-0** / **d-1** is stored in the EEPROM's memory. When the meter is turned ON, the dose mode is automatically set according to the last mode used before the meter was turned off.

3.6. Threshold Selection

The threshold value can be selected from a list of 11 programmed values (for AMP-50 – a list of 15 programmed values). The selected value is kept in memory even after the meter is turned off or the user can input the threshold settings using the Meter View software using the settings in section 1.3.2.

The following threshold values may be selected:

AMP-50 0.025, 0.050, 0.075, 0.1, 0.5, 2.5, 10, 25, 50, 100, 250, 500, 750, 3999 [mR/h]

AMP-100 0.05, 0.2, 5, 10, 25, 50, 100, 250, 500, 750, 999.9 [R/h]

AMP-200 5, 10, 25, 50, 100, 250, 500, 1000, 5000, 10000, 15000 [R/h]

To choose the required threshold value, proceed with the following steps:

3.6.1. Enter threshold mode by pressing the MODE push-button for two seconds. The reading will be zero, after which the **thr.** LCDs will be displayed to indicate that the threshold setting mode is activated.

3.6.2. Pressing the SPEAKER push-button displays the existing threshold value.

3.6.3. Each additional press on the SPEAKER push-button advances the display to the next threshold value, according to the order described in section 3.6.

3.6.4. To exit set threshold mode and to save the new threshold value, press the MODE push-button for two seconds. Saving will be verified by blinking of the new threshold value.

3.6.5. To exit the set threshold mode without saving new value (cancel threshold change), press RESET push-button for a very short period (less than two seconds). Saving will be verified by blinking of the "old" threshold value

3.7. Alarms

a. ***Detector alarm*****:** If the detector is defective or disconnected, the **Err.** LCDs will blink on the display and an interrupted audible alarm will be activated. To mute the audible alarm, press the SPEAKER push-button.

If the detector is defective the alarm will be activated as follows:

AMP-50 - after 2 minutes
AMP-100 - after 15 minutes
AMP-200 - after 120 minutes

If the detector is disconnected for at least one second, the error and audio alarms are activated. If the error condition (detector disconnection) lasts more than one minute, the meter is turned off automatically.

***b. Battery alarm*:** If battery voltage decreases below 6.2 Volts, the **bAt**. LCDs blink on the display and an interrupted audible alarm is activated.

To display the measured readings and mute the audible alarm, press the SPEAKER push-button. After the SPEAKER push-button is pressed, the **bAt.** LCDs will reappear every five minutes for two seconds, and every 30 minutes accompanied by an audible beep to remind users of the low battery condition.

***b. Overflow alarm*:** If the displayed count rate is higher than the meter's measuring range:
AMP-50 4000 mR/h,
AMP-100 1000 R/h,
AMP-200 15000 R/h,
the **OFLO** LCDs blink on the display and an interrupted audible alarm is activated. To mute the audible alarm, press the SPEAKER push-button.

***d. Threshold alarm*:** If the reading exceeds threshold value, the **ALr.** LCDs and the reading are displayed alternately, accompanied by an audible beep.

Pressing the SPEAKER push-button mutes the audible alarm, but the **ALr.** LCDs and the reading are continuing to be displayed alternately, until the reading decreases to 75% of the threshold value. If the reading exceeds threshold value and then quickly decreases to below 75% of threshold value, the **ALr.** LCDs and the beep are automatically cancelled, even though the SPEAKER push-button has not been pressed.

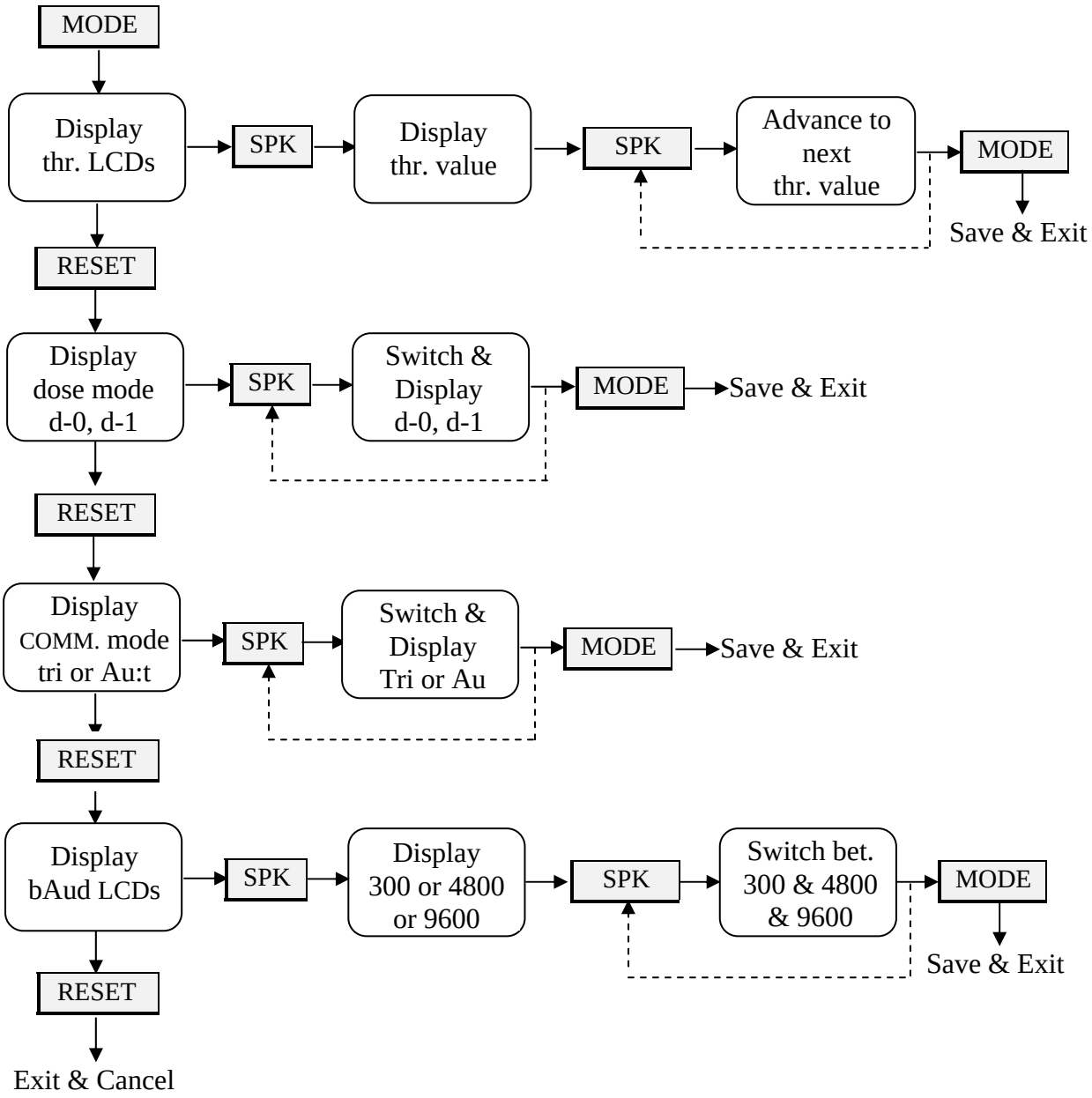
3.8. Push-button Functions

Note:
For operating RESET perform a short press on RESET / MODE push-button.
For operating MODE perform a long press on RESET / MODE push-button.

Function	Push-Button
Meter on/off	ON / OFF
Instantaneous reading reset	RESET
Mutes audible alarm	SPEAKER
Dose display	RESET + SPEAKER
In / out setting meter's parameters	MODE
In / out setting meter's ID #	Long SPEAKER (5 sec.)
Displays and enables calibration factors setting	RESET + SPEAKER (within calibration mode)

3.9. Meter's Parameters Setting Flowchart

Reading:
RESET ⇒ Short press (less than 2 seconds) on RESET / MODE push-button.
MODE ⇒ Long press (more than 3 seconds) on RESET / MODE push-button.



3.10. Battery Replacement

The battery compartment is located at the instrument back. To replace the battery, slide out the battery compartment cover carefully. Use one 9-Volt alkaline battery; be sure to connect it with the right polarity.

External Power Supply

The AMP is equipped with an external DC input, may be operated either with a 9V battery or an external 9V DC power supply. The battery can be used in conjunction with the external power supply. In case of external power failure the battery supplies the current. The DC voltage should be 10 to 12 Volts, to avoid drain current from the battery. ***The internal battery remains connected to function as a back-up power supply***.

4. Communications

The AMP communication is available in two methods:

1. Meter to DDC-16/AM-16 Area Monitor (wired) or to WRM external transmitter (wireless).
2. Direct download from Meter to PC using the supplied connector, RTM-9128.

4.1. Meter to DDC-16/AM-16 Area Monitor (wired) or to WRM

To download data from the AMP's meter to the TeleMap or Teleview system, connect the meter to the DDC-16/AM-16 or the WRM transmitter via the WRM adapter and telephone cable.

Tri mode (trigger for WRMPlus) – The meter transmits a data record each time it receives a trigger from the customized cable.

Each time the AMP's meter receives a trigger from the DDC-16/AM-16 Area Monitor (wired) or the WRM, the meter transmits a data record to the Smart Online system.

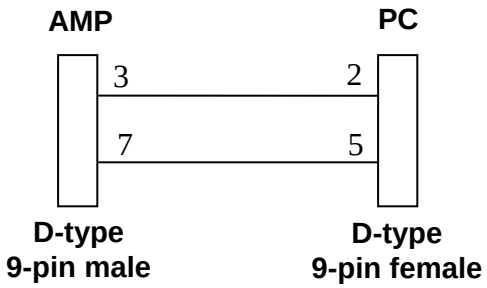
4.2. Direct Download from Meter to WRM2 or PC

Auto mode (Automatic for WRM2 or PC) - The meter transmits a data record at fixed preset time interval which can be selected by the user as follows: 4, 10, 30, 60 [sec.]. The correct baud rate setting(s) must be correct for the AMP in order for the WRM2 EXT Transceiver or PC to view the data correctly.

4.3. Hardware Components

The WRM (gray color) adapter (D-type to telephone) and telephone cable are designated to connect the AMP's meter to the DDC-16/AM-16 Area Monitor (wired) or to the WRM transmitter.

The following cable is designated to connect the AMP's meter to the WRM2 EXT Transceiver or PC while working in automatic mode or use the **supplied connector RTM-9128**.



4.4. WRM2 EXT Transceiver Settings

- Baud Rate - the EXT radio must be set for the same baud rate as the one used by the instrument. Available range is from 300 to 115,000 BPS (default 9600 Baud, N, 8, 1).
- Transmit mode – the EXT radio must be configured in cyclic sleep mode to strobe the data from the external device or in no sleep for devices that output data at regular intervals.
- Serial protocol – the EXT TXD and RXD data lines must be configured for the proper serial protocol. Two modes are included, TTL serial (0 V – 3 to 5 VDC) or standards RS-232 (-8 to -12 VDC to + 8 - +12 VDC)
- Pin 1 can be configured for VDC output (5V or 7-15 VDC) or input (DMC/AMP connection) or for RXD for two-way communications.
- Slide (DIP) Switch configuration for the EXT is depicted in **Table 3** below:

Table 4.1 WRM2 EXT Slide Switch & Baud Rate Parameters

	SW 1		SW 2		SW 3		SW 4		SW 5		Baud Rate
Position	232	TTL	DATA	STROBE	232	TTL	IN	OUT	5V	15V	
	(Data Out)		(Data/Strobe)		(Data In)		(PWR In/Out)		(PWR Out)		
DMC2000				X		X		X	X		4800
DMC100				X		X		X	X		300
AMP	X		X		X		X			X	9600[2]
ABPM CAM	X		X		X						38400[1]
PROGRAM RADIO	X		X		X						

Notes:
1: Baud Rate shown for ABPM-203 Continuous Air Monitor (CAM). For other non-MGPI CAM's, refer to respective owner's manual for communication parameters and supported protocol (for example, AMS-4 – Baud Rate: 19,200, RadNet protocol compliant).
2: For TelePole connectivity, use AMP settings. RAM-ION is not supported at this time.

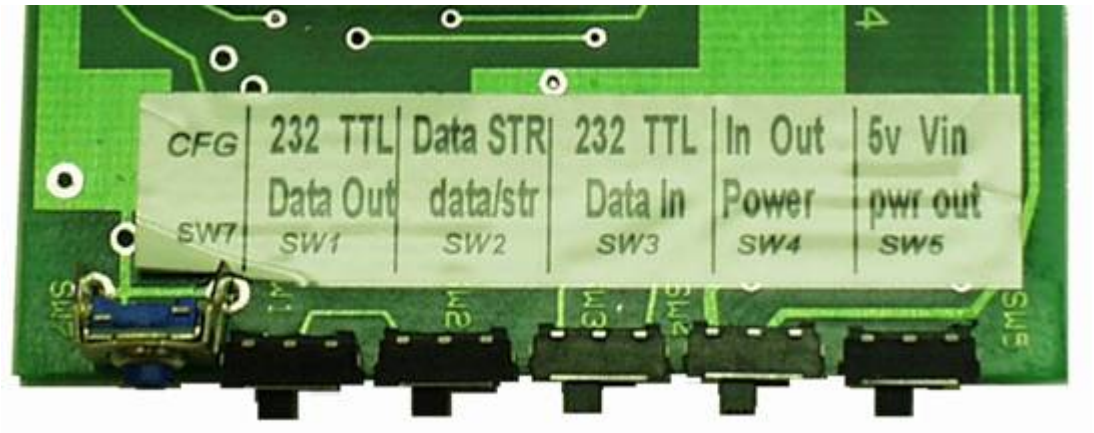


Figure 4.1 EXT Board – Slide Switch Configuration

4.5. Communication Protocol

Byte	Description	
1	LF	Meter ID serial number
2	N5	
3	N4	
4	N3	
5	N2	
6	N1	
7	N0	
8	Status1 msb	OK = 30H, det. fail = 38H, over thr. = 32H
9	Status1 1sb	
10	D5	Dose [mR]
11	D4	
12	D3	
13	D2	
14	D1	
15	D0	
16	D-1	
17	30H	
18	X	Rate = X.YZW x 10^{T} [mR/h]
19	Y	
20	Z	
21	T	
22	W	
23	Status 3 lsb	
24	CS msb	
25	CS lsb	
26	CR	

The user may select one of the following baud-rates: 300, 4800, 9600.
Byte format: 8 bit, 1stop bit, no parity.

5. Calibration

5.1. Switching the AMP's Meter into Calibration Mode

- Open the AMP battery compartment cover and turn the internal dip-switch 4 (the right dip-switch, see Figure 5-1) to the ON (calibration) position. The dip-switch position is specified by a **Cal.** label inside the battery compartment.
- The Cal. LCDs are displayed.
- To display the current calibration factors press the RESET push-button. The display will start flashing between the reading and the factors.

→ F1 → 1.07F → F2 → 0.99F → F3 → 0.96F → 0.01 →
↑ ↓

Dip-Switch U9

1 - ON
2 - ON
3 - OFF
4 - ON - Calibration
OFF - Operation

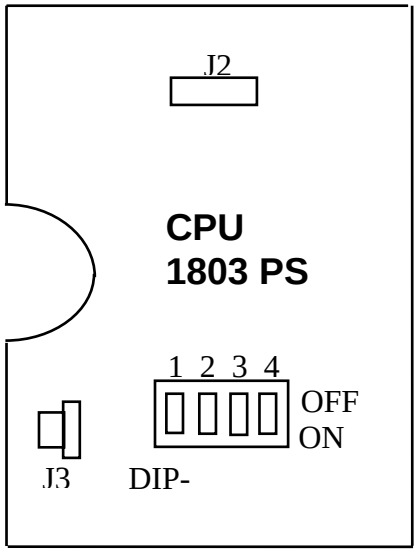


Figure 5-1. CPU Card

5.2. Calibration for AMP-50

To improve linearity, the AMP-50 includes three calibration factors.
The calibration factors are displayed in the **CAL.** mode by pressing the RESET push-button.

F1, the first calibration factor, is used to compensate the Geiger sensitivity tolerance.

F2, the second calibration factor and

F3, the third calibration factor, are used as the dead time correction factors.

Calibration of AMP-50 requires checking of each of the three factors. In addition, as factors are checked, one or more may need to be adjusted.

F1 should be checked / adjusted at 10 mR/h ±2 mR/h

F2 should be checked / adjusted at 600 mR/h ±120 mR/h

F3 should be checked / adjusted at 2000 mR/h ±400 mR/h

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

Up to 1000 mR/h: N(R/h) = [n*F1 + dead time correction {n*F2}] / 17

Over 1200 mR/h: N(R/h) = [n*F1 + dead time correction {n*F3}] / 17

Where:

n is the detector frequency obtained in the radiation field

N is the updated measurement reading

Between 1000 mR/h to 1200 mR/h, a weighed 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) - 1000) / 200

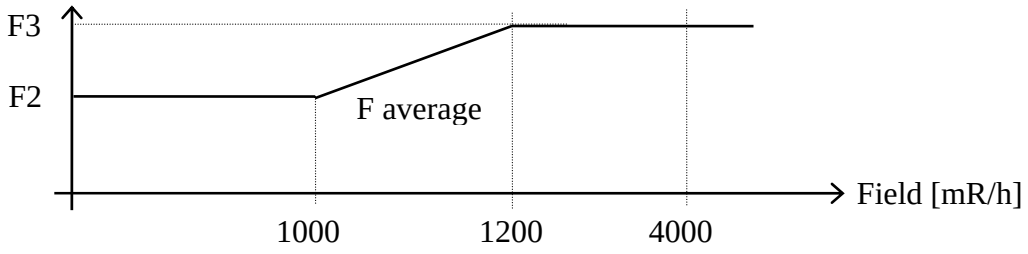
Last N = previous measurement reading

F average = (1-x)* F2 + x* F3

N(R/h) = [n*F1 + dead time correction {n*F average} / 17

The following graph illustrates the ranges over which F2, F3 and F average are used as the AMP-50's dead time correction factor:

Dead time correction factor



5.3. Calibration Procedure for AMP-50

5.3.1. To set the factors, press the SPEAKER and RESET push-buttons simultaneously.

In a field higher than 1 mR/h, 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 1 mR/h and lower than 50 mR/h.

F2 if the probe head is in a field higher than 50 mR/h and lower than 1100 mR/h.

F3 if the probe head is in a field higher than 1100 mR/h.

Expose the detector to a radiation field of 10 mR/h ±2 mR/h.
Press the RESET + SPEAKER push-buttons simultaneously.
The display will show:

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

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

5.3.2. Expose the detector to a radiation field of 600 mR/h ± 120 mR/h.

The display will show:

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

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

5.3.3. Expose the detector to a radiation field of 2000 mR/h ± 400 mR/h.

The display will show:

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

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

5.3.4. When the required reading (factor) is obtained, turn the internal switch back to the measuring position and the meter will enter the measuring mode. The calibration factors values are between 0.60 to 1.40 and are stored in the EEPROM.

5.4. Calibration for AMP-100

To improve linearity, the AMP-100 includes three calibration factors.
The calibration factors are displayed in the **CAL.** mode by pressing the RESET push-button.

F1, the first calibration factor, is used to compensate the Geiger sensitivity tolerance.

F2, the second calibration factor and

F3, the third calibration factor, are used as the dead time correction factors.

Calibration of the AMP-100 requires the checking of each of the three factors. In addition, as the factors are checked, one or more may need to be adjusted.

F1 should be checked / adjusted at 10 R/h ±2 R/h

F2 should be checked / adjusted at 200 R/h ±60 R/h

F3 should be checked / adjusted at 600 R/h ±100 R/h

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

Up to 300 R/h: N(R/h) = [n*F1 + dead time correction {n*F2}]/300

Over 400 R/h: N(R/h) = [n*F1 + dead time correction {n*F3}]/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 weighed 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

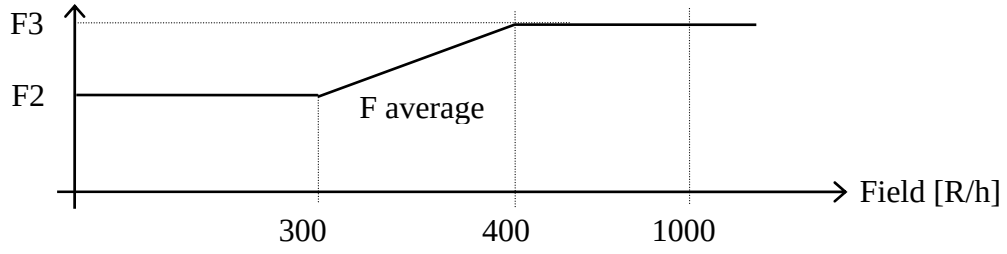
Last N = previous measurement reading

F average = (1-x)* F2 + x* F3

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 AMP-100's dead time correction factor:

Dead time correction factor



5.5. Calibration Procedure for AMP-100

5.5.1. To set the factors, press the SPEAKER and RESET push-buttons simultaneously.

In a field higher than 10 mR/h, 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 50 R/h.

F2 if the probe head is in a field higher than 50 R/h and lower than 350 R/h.

F3 if the probe head is in a field higher than 350 R/h.

5.5.2. Expose the detector to a radiation field field of 10 R/h ±2 R/h.

Press the RESET + SPEAKER push-buttons simultaneously.
The display will show:

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

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

5.5.3. Expose the detector to a radiation field of 200 R/h ±60 R/h.

The display will show:

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

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

5.5.4. Expose the detector to a radiation field of 600 R/h ±100 R/h.

The display will show:

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

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

5.5.5. When the required reading (factor) is obtained, turn the internal switch back to the measuring position and the meter will enter the measuring mode. The calibration factors values are between 0.60 to 1.40 and are stored in the EEPROM.

5.6. Calibration for AMP-200

To improve linearity, the AMP-200 includes three calibration factors.
The calibration factors are displayed in the **CAL.** mode by pressing the RESET push-button.

F1 -the first calibration factor is used to compensate the Geiger sensitivity tolerance.

F2 - the second calibration factor and

F3 - the third calibration factor, are used as the dead time correction factors.

Calibration of the AMP-200 requires the checking of each of the three factors. In addition, as the factors are checked, one or more may need to be adjusted.

F1 should be checked / adjusted at 20 R/h ±5 R/h

F2 should be checked / adjusted at 1000 R/h ±200 R/h

F3 should be checked / adjusted at 8000 R/h ±1000 R/h

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

Up to 3500 R/h: N(R/h) = [n * F1 + dead time correction {n * F2}] /77

Over 5500 R/h: N(R/h) = [n * F1 + dead time correction {n * F3}] /77

Where:
n is the detector frequency obtained in the radiation field
N is the updated measurement reading

Between 3500 R/h to 5500 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 - 3500) /2000

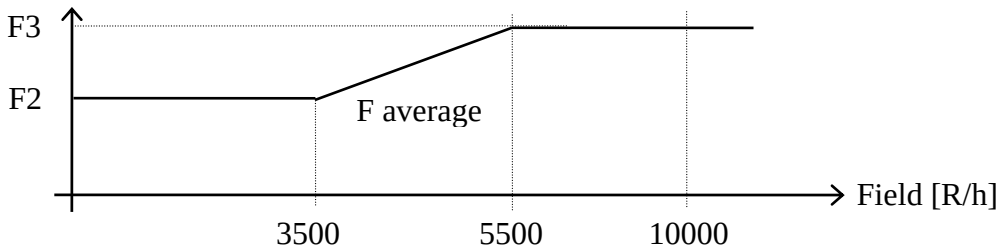
Last N = previous measurement reading

F average = (1-x) * F2 + x * F3

N = [n * F1 + dead time correction {n * F average}/77

The following graph illustrates the ranges over which F2, F3 and F average are used as the AMP-200's dead time correction factor:

Dead time correction factor



5.7. Calibration Procedure for AMP-200

5.7.1. To set the factors, press the SPEAKER and RESET push-buttons simultaneously.

In a field higher than 1.0 R/h 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 between 1.0 R/h to 500 R/h.
F2 - if the probe head is in a field between 500 R/h to 6000 R/h.
F3 - if the probe head is in a field higher than 6000 R/h.

5.7.2. Expose the detector to a radiation field field of 20 R/h ±5 R/h.

Press the RESET + SPEAKER push-buttons simultaneously.
The display will show:

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

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

5.7.3. Expose the detector to a radiation field of 1000 R/h ±200 R/h.

The display will show:

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

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

5.7.4. Expose the detector to a radiation field of 8000 R/h - ±1000 R/h.

The display will show:

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

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

5.7.5. When the required reading (factor) is obtained, turn the internal switch back to the measuring position and the meter will enter the measuring mode. The calibration factors values are between 0.60 to 1.40 and are stored in the EEPROM.

5.8. CPU Unit Pulser Check

Note:

Although it is possible to "calibrate" the AMP meters using a series of input pulses (from a pulser), the manufacturer strongly recommends against this. Checking the instrument response to input pulses ensures the meter's proper operation, *but indicates nothing about the detector.* The manufacturer recommends that the AMP system should be calibrated according to the calibration procedure described in this manual, meaning exposing the probe head to known radiation fields and adjusting factors appropriately. This process ensures that both, the detector and the meter, operate properly.

The meter counts input pulses, calculates dead time correction, averages the calculation results and displays the reading. The meter may (optionally) be checked by the following procedure.

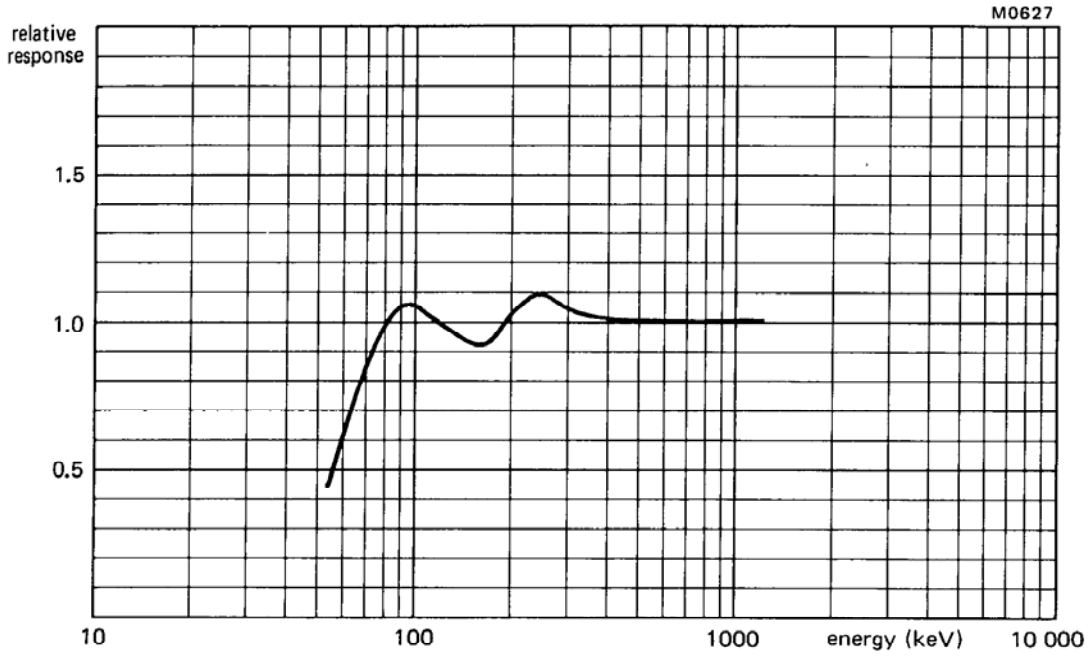
- Disconnect the detector D-type connector from the meter.
- Adjust the output pulser to obtain a five Volts amplitude and 10 μsec width pulse.
- Connect the output pulser as follows: (+) to pin 1 and (-) to pin 6.
- First, turn the meter on, and then turn the pulser on. Ensure that the meter reads (within ±10%) according to the following table:

AMP-50		AMP-100		AMP-200	
Input Frequency [Hz]	**Display [mR/h]**	**Input Frequency [Hz]**	**Display [R/h]**	**Input Frequency [Hz]**	**Display [R/h]**
340	20	30	0.100	77	1.0
3000	229	300	1.000	770	10.0
4000	335	3200	10.73	9612	136
5000	490	10000	39.26	47256	1098
53000	530	30000	196	98712	5748
6000	664	40000	329	123710	12.4E = 12400
7000	751	50000	525	132933	OFLO
7500	943	60000	815		
8000	1055	75000	OFLO		
10000	1609				
13000	2889				
15000	OFLO				

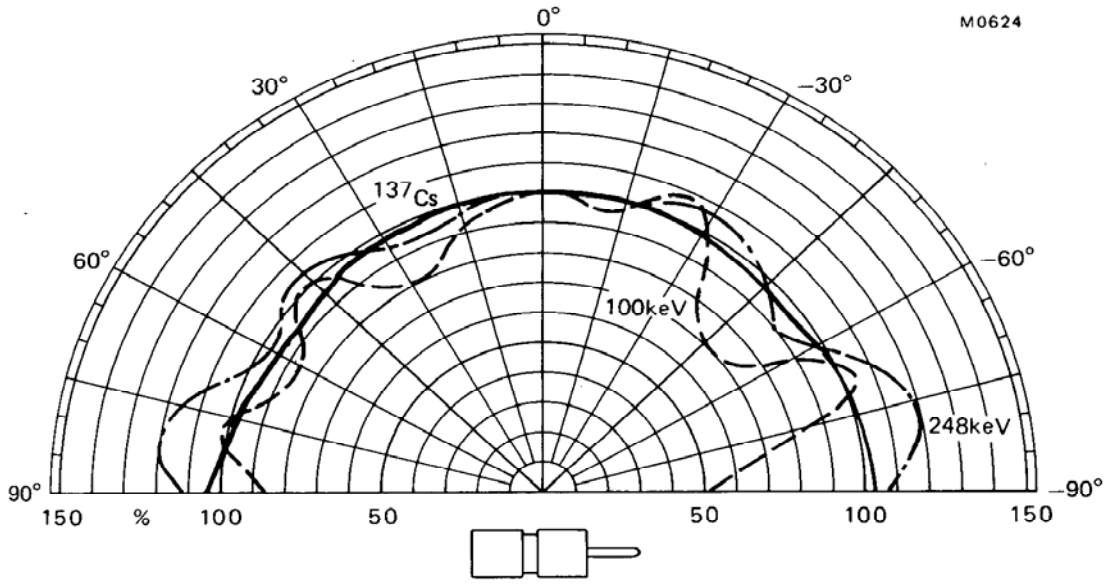
These results are valid only when all factors are equal to 1.

6. Energy Response

Energy Response for AMP-50 and AMP-100

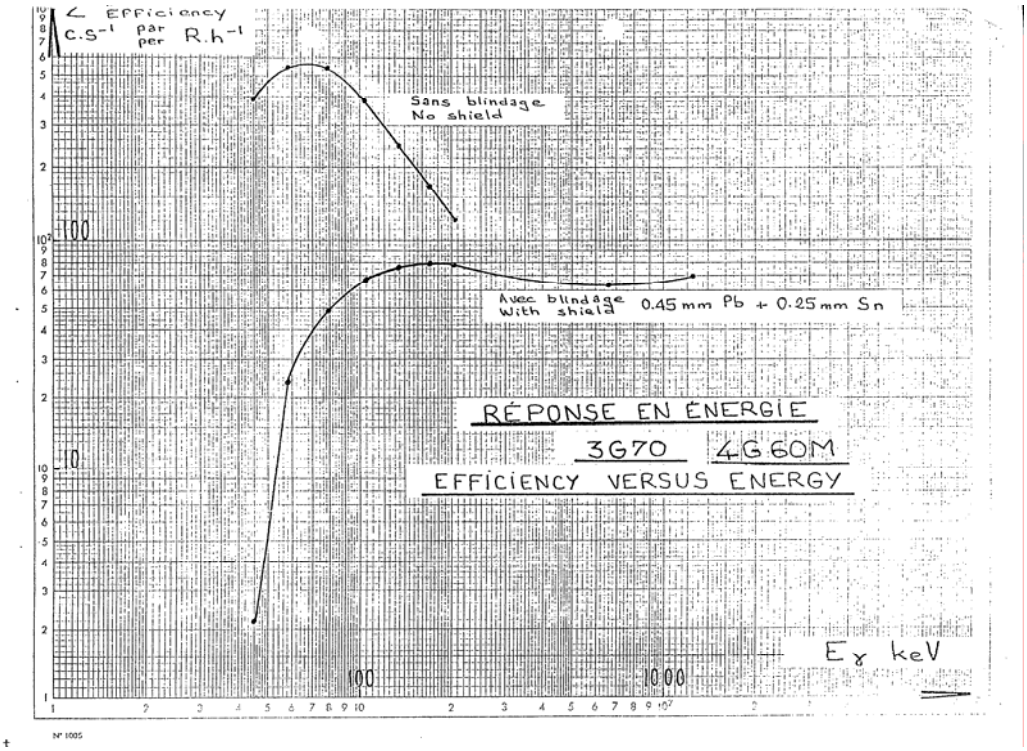


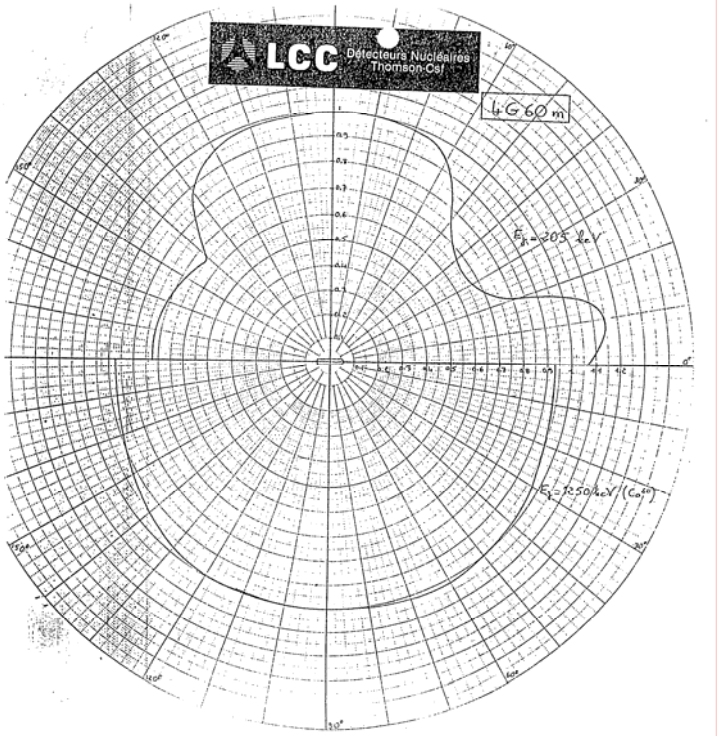
Typical energy response relative to ^{137}Cs



Typical polar responses (normalised to 100% at 0°)

Energy Response for AMP-200





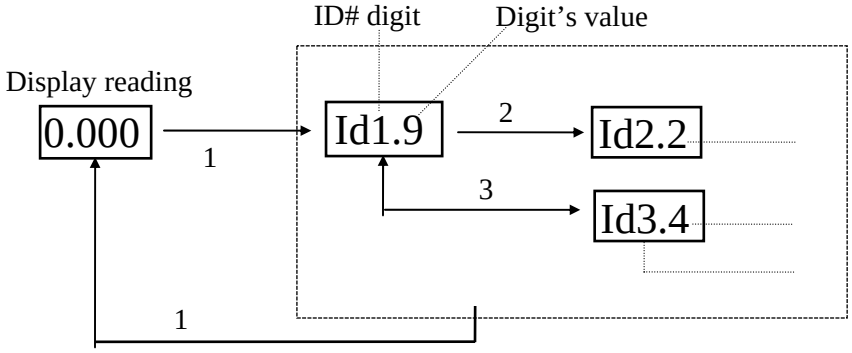
7. Setting the Telemetry ID Number

Each AMP meter includes both, a factory serial number marked on the meter case label, and a Telemetry ID number for communication purposes.

Note: ***Setting the ID # must be done only by an authorized user***.

7.1. Setting and Checking the Telemetry ID

The ID # includes six digits.
The first digit in the ID # indicates the meter type, default '9'.
By default, the AMP first digit always equals to 9.



1 - Long press (5 sec.) on SPEAKER push-button – In/Out display and set ID #.
2 - Short press on SPEAKER push-button - Increases displayed digit value.
3 - Short press on RESET push-button - Displays next digit value.
4 - Long press (5 sec.) on SPEAKER push-button to store and exit the parameter setting.

For example: ID # = 932001

Id1.9 Id4.0

9 32 001

Meter type year serial #
(AMP100)

Meter Code for Telemetry

Instrument	Type Code
TelePole	0
Ram Ion	1
AMP-50	2
AMP-100	3
AMP-200	4
DRM	5
DRM-1D	6

7.2. Correlation Between the Factory Serial Number and the ID

	Factory S.N.	ID #
AMP- 50	09 02 801	9 22 801
AMP-100	50 02 001	9 32 001
AMP-200	77 02 501	9 42 501

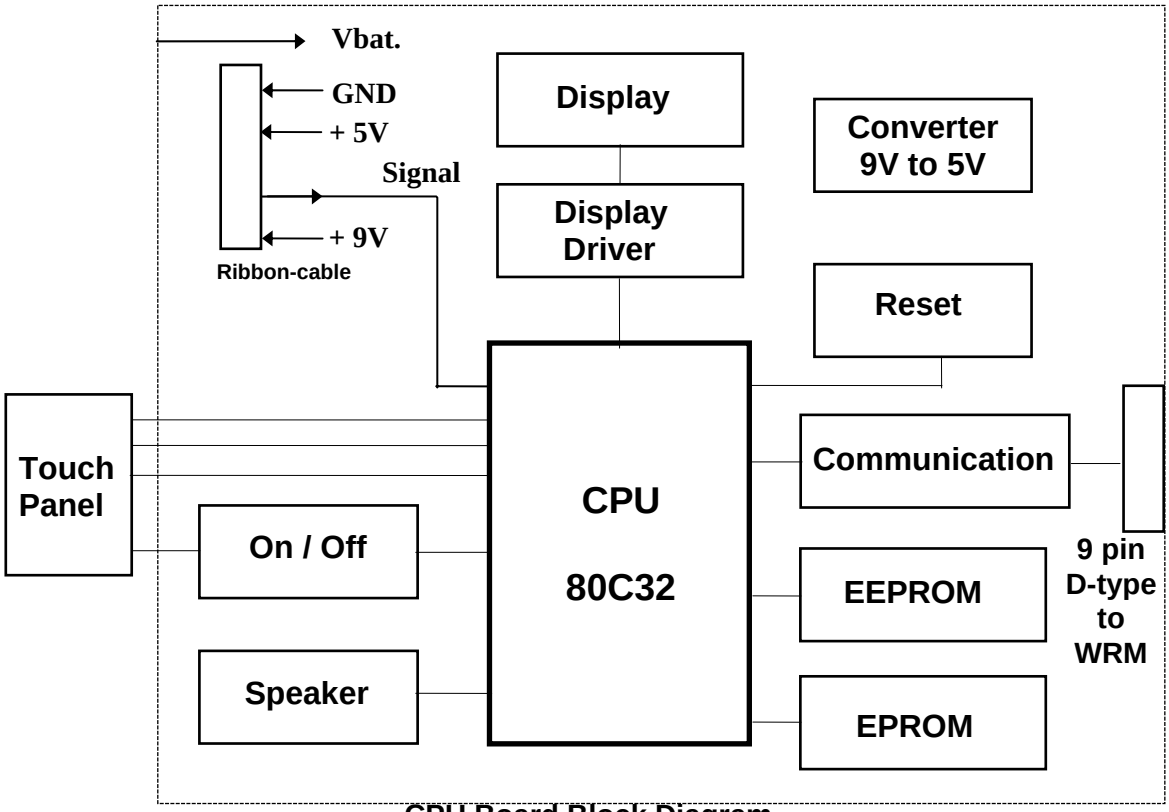
8. Electronic Block Diagrams Description

See block and wiring diagram DRW# 12730-50-03.

7.3. Meter

The meter unit includes the CPU and high voltage (HV) boards.

7.3.1. CPU Board Description



CPU Board Block Diagram

CPU Board
DRW #12730-43-00, PC #1938.

On /Off Circuit (Q1, Q3, Q4)
A momentary short between pin J2/1 and J2/2 switches Q1 and Q4 on.
The battery voltage powers the LM2931 converter.
U5/8 is set to "1" (in software), Q1 is switched on, and as a result the meter is turned on.
An additional momentary short between J2/1 and J2/2 sets U5/9 to "0" through Q3. U5/8 is set to "0" and the meter is turned off.

Reset
When the meter is turned on, the CPU receives a reset signal via C13.

Speaker Circuit (U3)
The speaker circuit is activated in the following cases:
a. Meter reading exceeds threshold level.
b. Instrument malfunction.
c. Indication of pressing push-button.
In each of the above cases U5/15 is set to 5 VDC, a 3 KHz signal on pin U3/3 activates the speaker.

Touch Panel
The touch panel push-buttons are directly connected to the micro-controller chip in the CPU board, except the on/off push-button, which is connected to the on-off circuit.

Display (U4, U8)
The display shows the meter readings.
The display driver (U4) receives serial data and clock from the CPU and transmits it in parallel to the display.
U8 - LCD, 4-character 7-segment, three decimal points and two column points.

EPROM Circuit (U6, U7)
U6 - 74HC 373, Address A_0 - A_7, latch from AD_O - AD_7 .
U7 - 27C 256, EPROM contains software code.

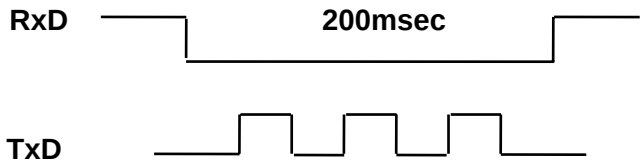
CPU Circuit (U5)
The micro-controller circuit manages all of the meter's activities.

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

External Communication Circuit

J4/3 TxD - This is the serial data line transmitted from the AMP-100. The signal 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.

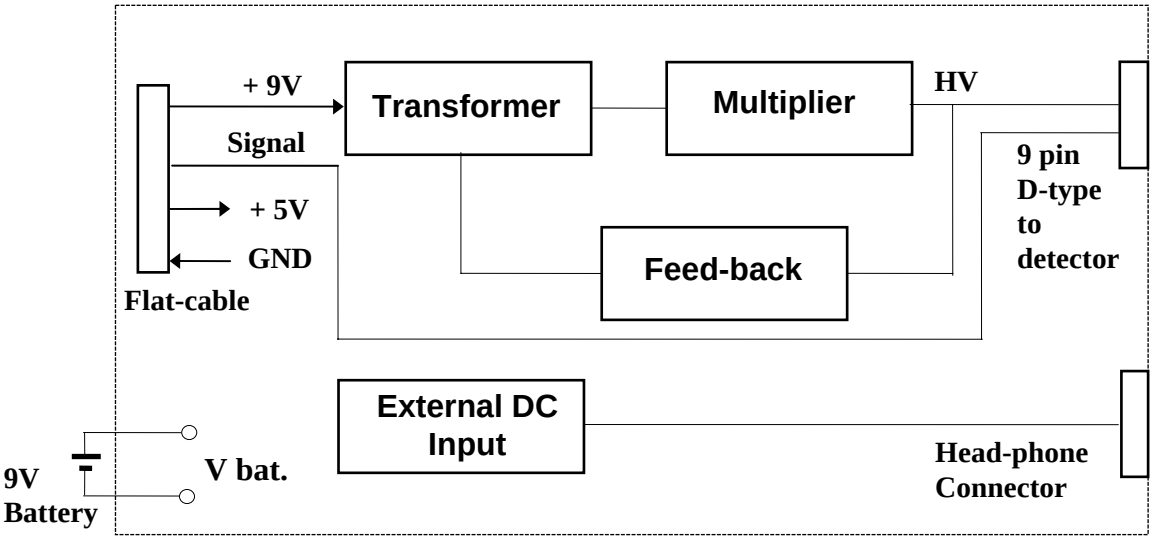
J4/2 RxD - This is the serial data line received in the AMP-100. The AMP-100 accepts serial data either in RS-232 signal levels (low: -3 to -15 Volts, high: +3 to 15 Volts) or TTL levels (low: 0.8 Volts, high: 2.0 Volts).
J4/7 – ground, J4/3 - + 5V
The communication port receives a trigger from the WRM transmitter and transmits the data to the WRM system.



Converter
The U2 - LM2931 - AZ 5.0 and two 4.7µF capacitors convert the 9V battery voltage to 5V. The input voltage range is from 5.6V to 26V.

7.3.2. High Voltage Board

DRW #12730-42-00.

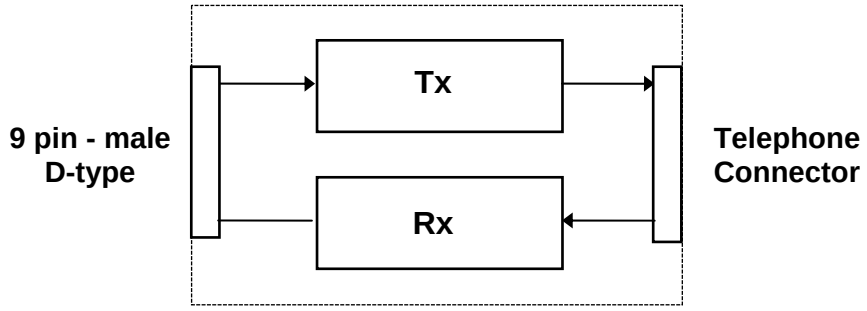


HV Board Block Diagram

High Voltage Board
The HV board includes an 8075 transformer, a voltage multiplier (D1, D2, D3, C2, C3), and an RV4192 switching regulator.
R10 and R1 are voltage feed-back for the switching regulator.

7.4. WRM Adapter

DRW #12730-40-00.

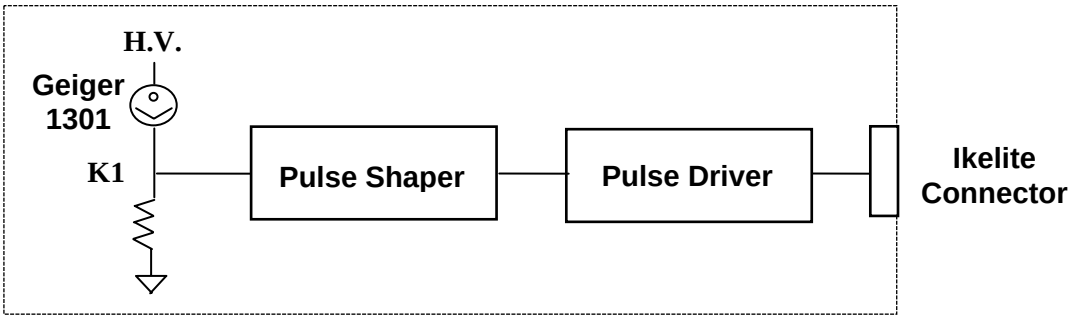


WRM Adapter Block Diagram

Adapter between the WRM transmitter and AMP-100 voltage levels.

7.5. Detector

DRW #12730-41-00.



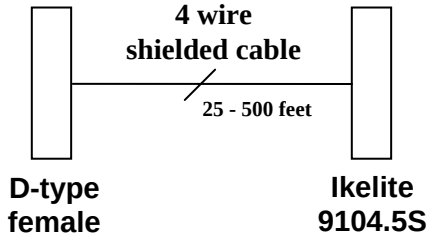
Detector Block Diagram

The high voltage, 500V ± 5% generated in the HV board is transmitted to the detector via the meter's cable. When the detector is positioned in a radiation field, positive pulses  are obtained on pin K1 of the Geiger. These pulses are shaped and amplified by Q1, Q2 and RC components. Q3 and Q4 drive these pulses in the meter's direction.

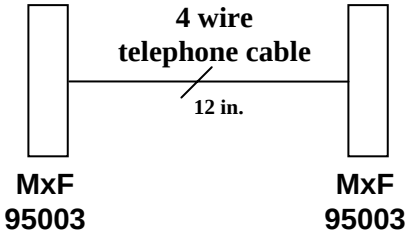
7.6. Cables

DRW #12730-50-00.

7.6.1. Meter to Detector



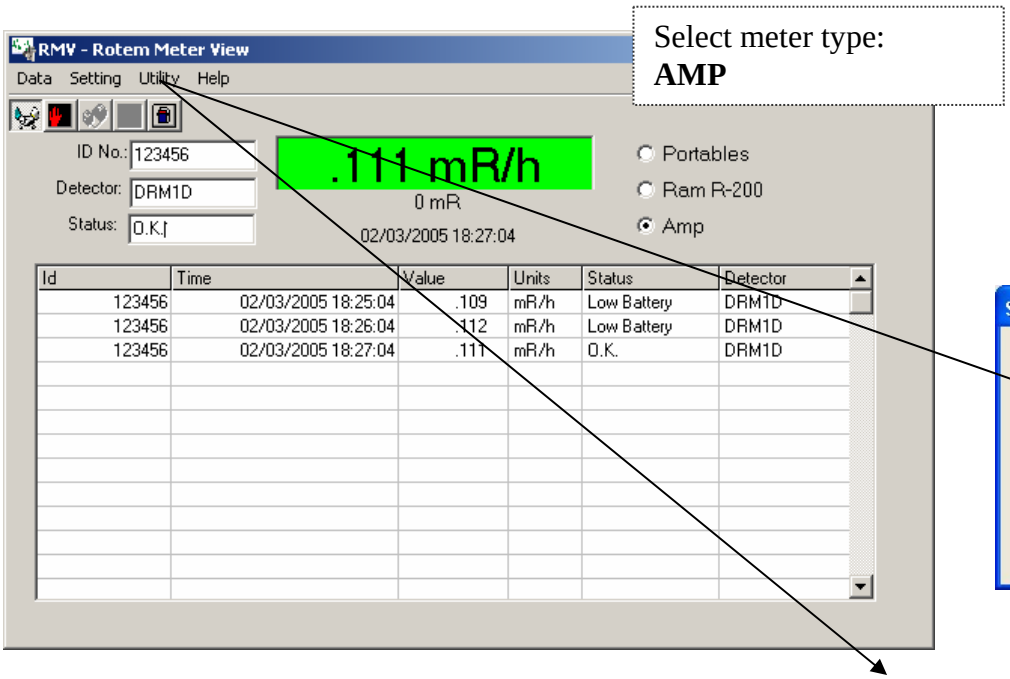
7.6.2. WRM Adapter to WRM Transmitter

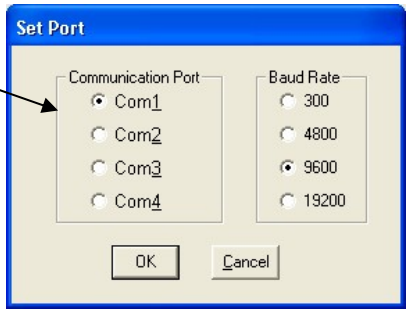


7.7. Power Supply

There are two ways to power the meter:
a. 9V battery.
b. External DC voltage (8V to 10V DC).

9. Setting meter parameter using the RMV software



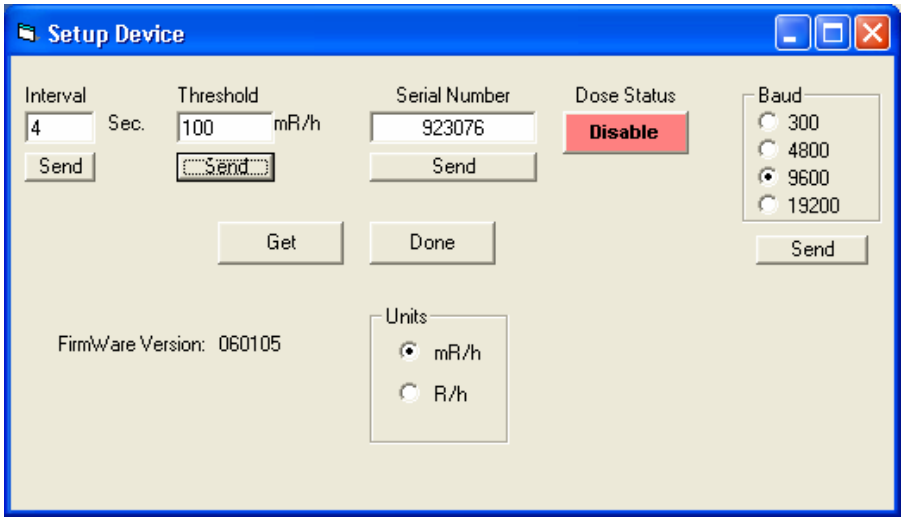


Set PC communication parameters

Set & display meter parameters

To set new parameter value, type the require value on each window and then click on the **Send** button.

e.g Interval =10 → send,
Threshold = 0.43 → send, etc.



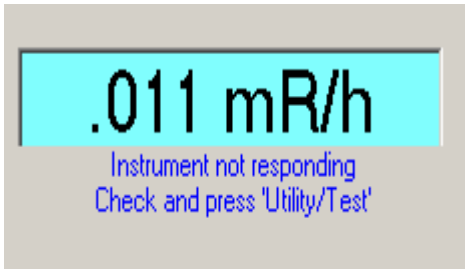
RMV Operating Instructions:

Start the RMV software; connect the AMP to the P.C. via the RS232 connection with the supplied connector, RTM-9128, supplied with the AMP detection system.

1) Set the correct Communication port and baud rate, i.e., **9600 Baud Rate**.

2) Select meter type to **AMP**.

3) Verify that the communication between the meter and the PC is okay. If the communication fails, change the baud rate by clicking on the **Setting** and then **Communication port** button, and select another baud rate (300, 4800, and 9600 BPS). Then click on **Utility**, **Test** to check again.



Failed communication

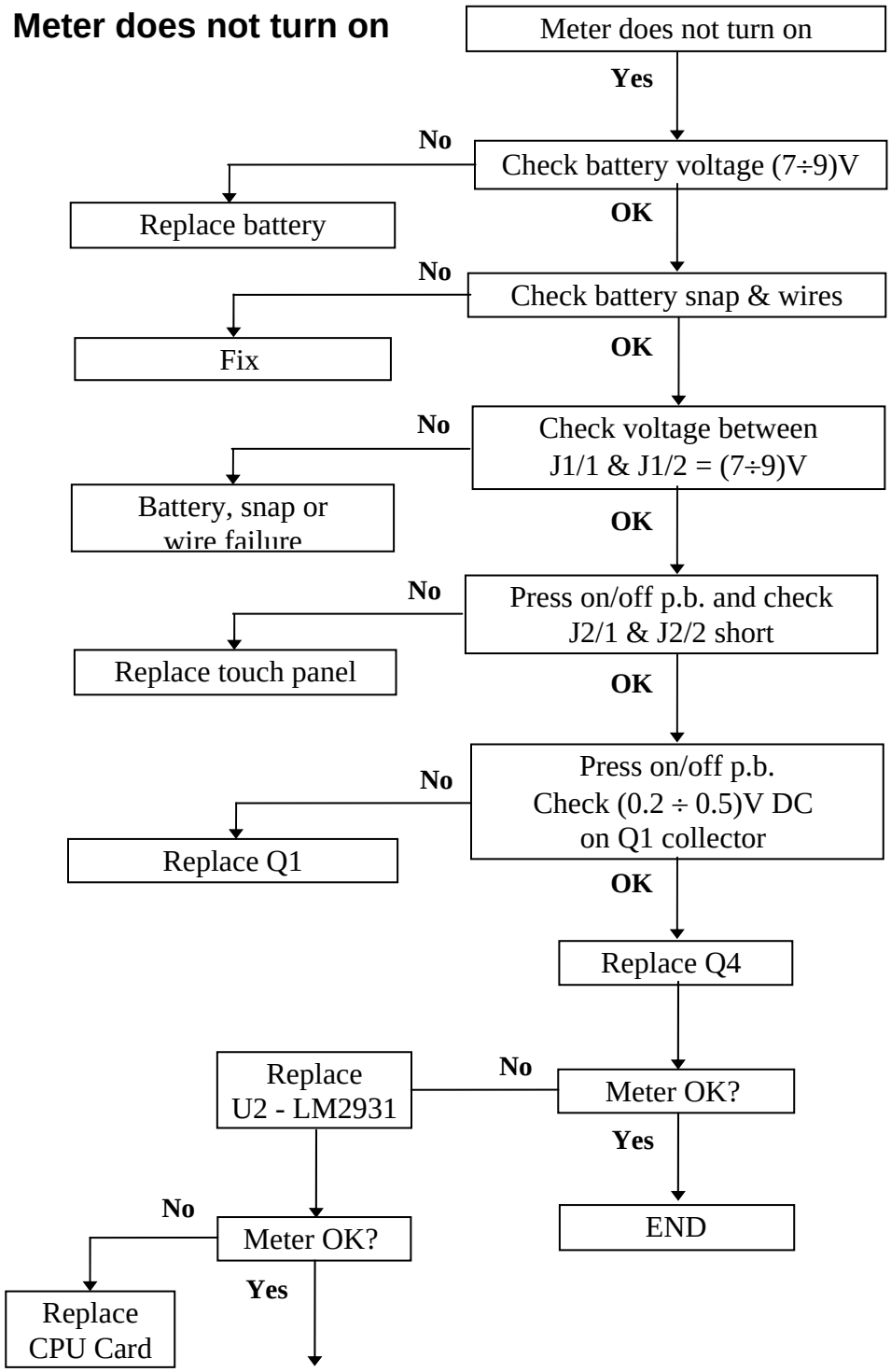
Communication OK

4) Once the communication is okay, use the **Setting and then Setup AMP** button to set the meter's working parameters.

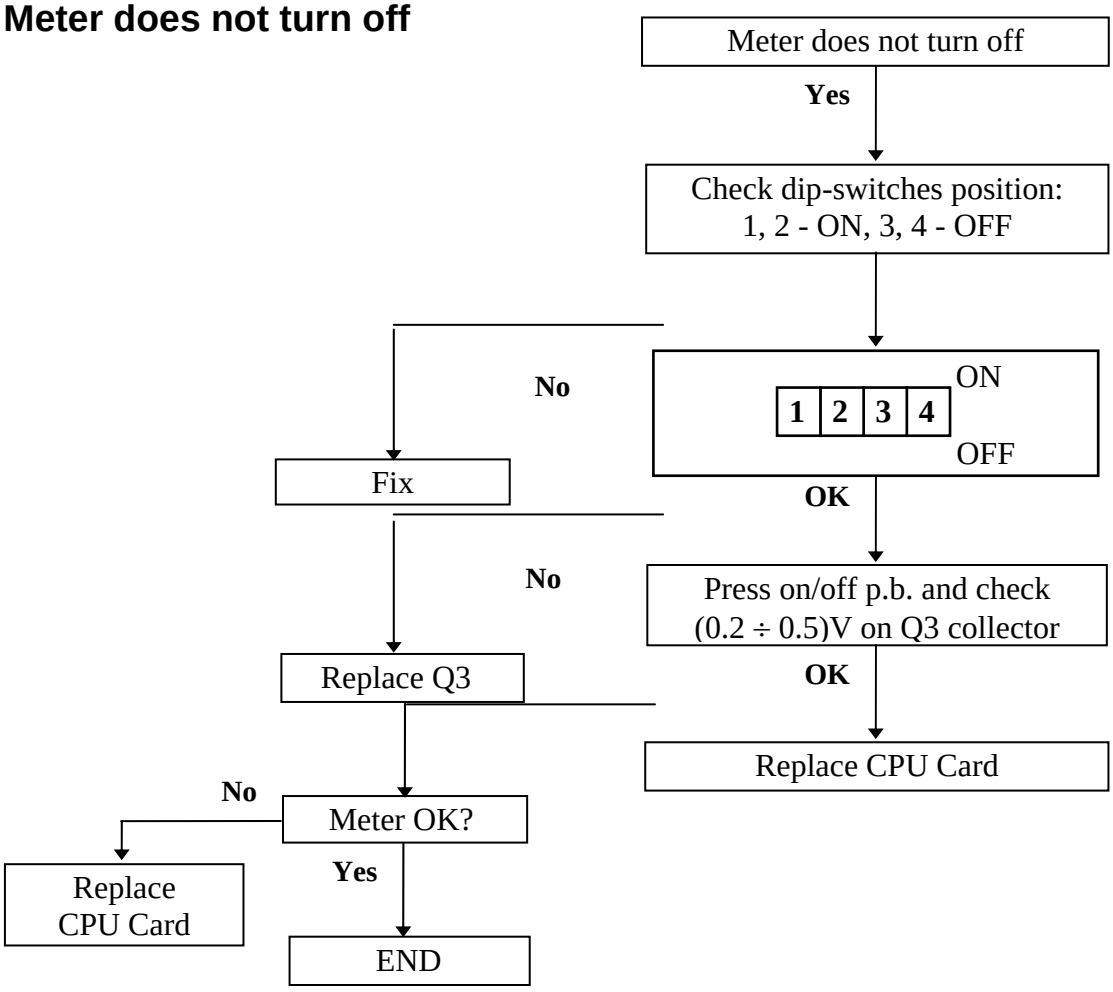
5) The Serial Number shown in the Setup Device screen refers to the ID number used in the communication protocol and not the serial number of the instrument which is setup using the RMC (Rotem Meter Calibration) or the AMP View software. All portable instruments telemetry ID will start with a '9' followed by the unique identification number.

10. Troubleshooting

10.1. Meter does not turn on

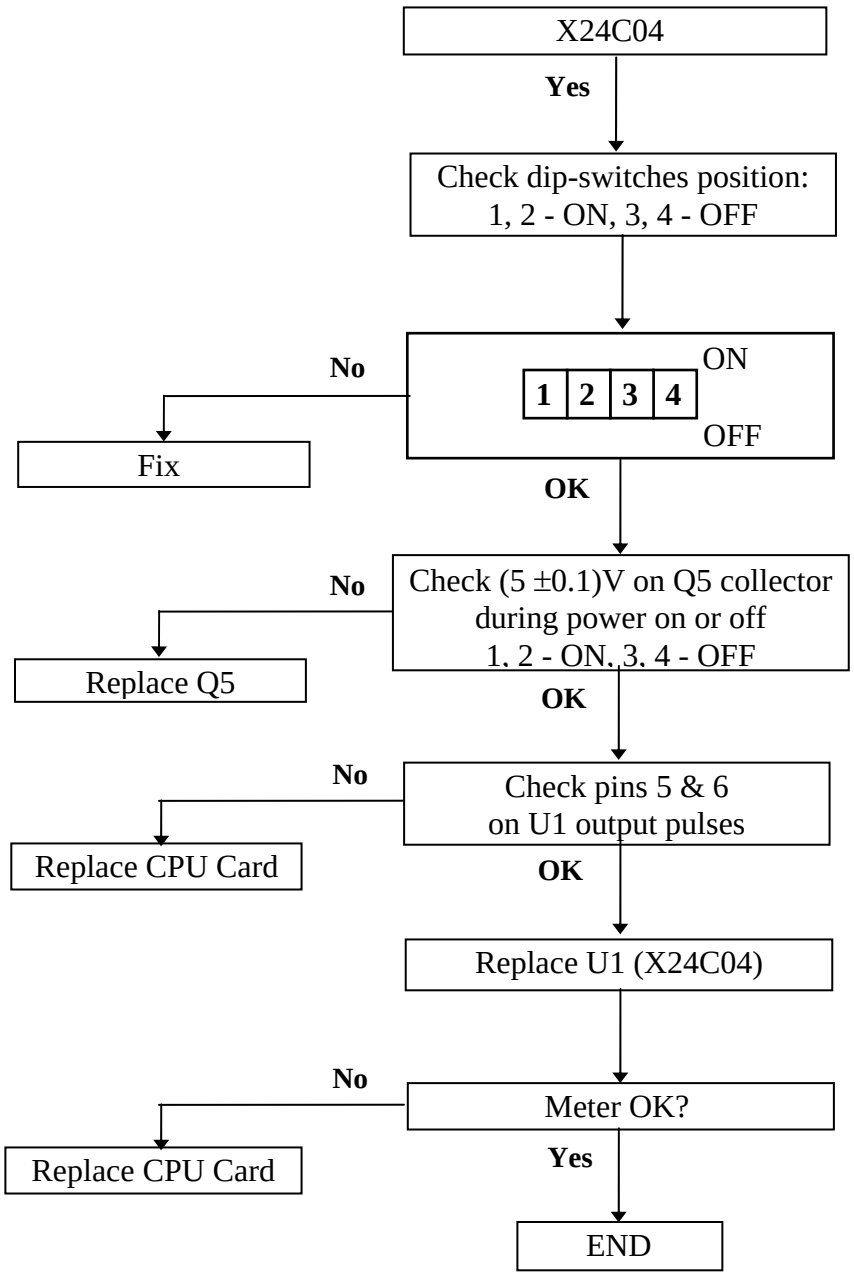


10.2. Meter does not turn off

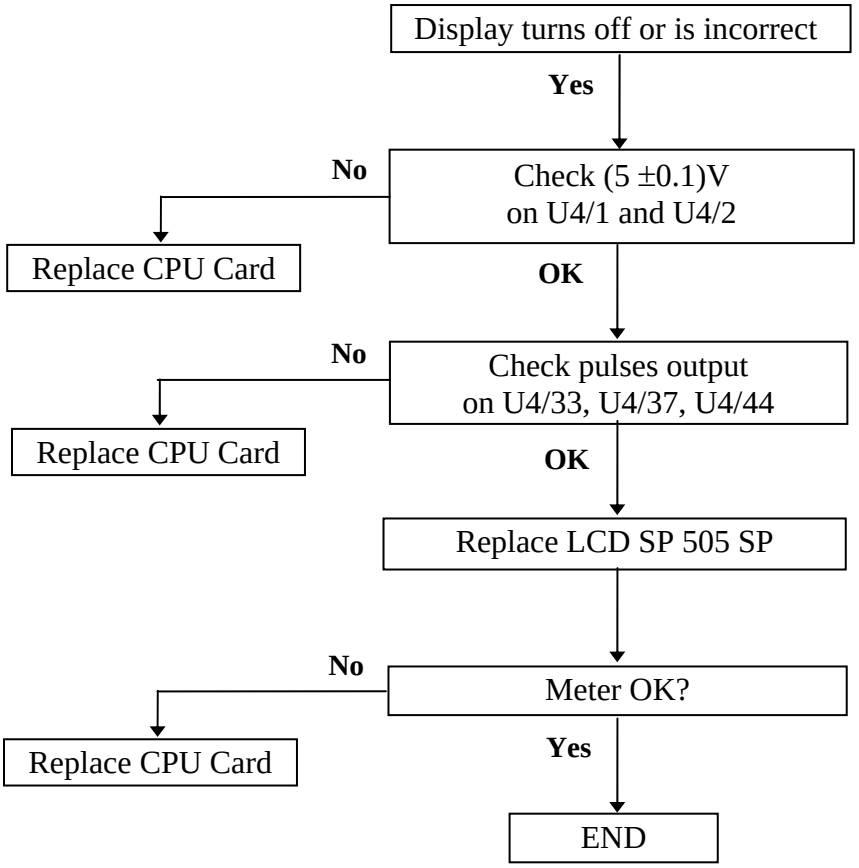


END

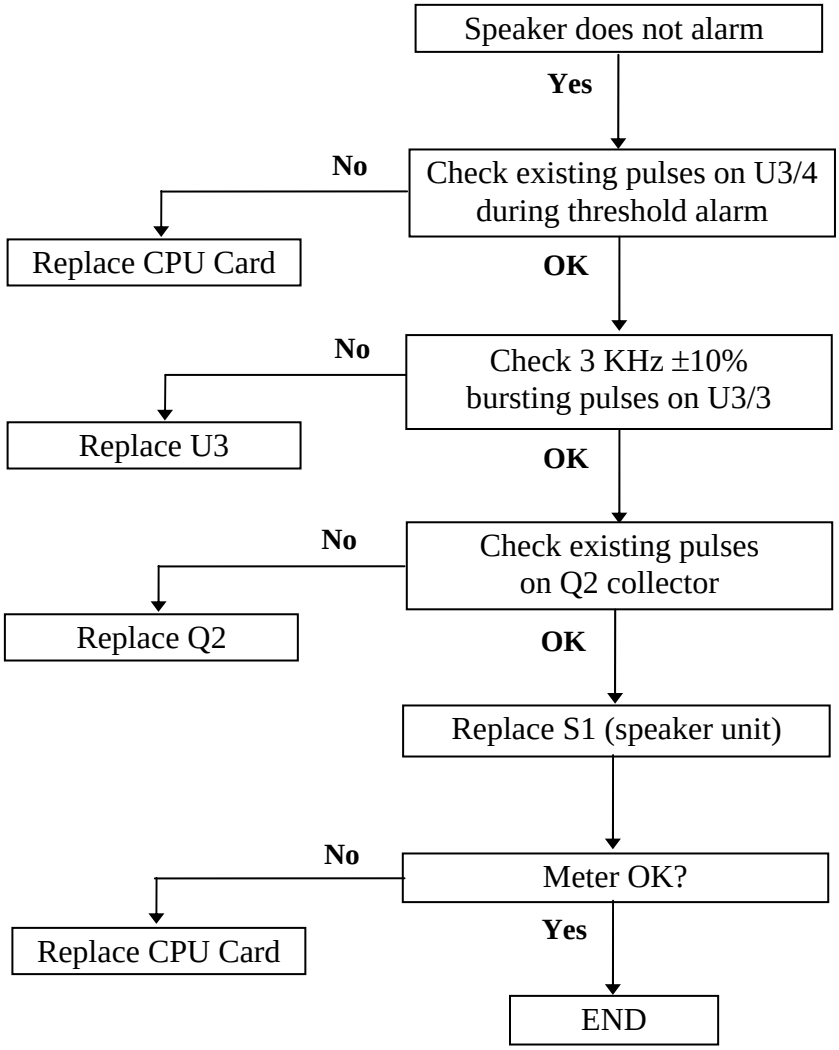
10.3. Meter parameters are not saved in the internal memory



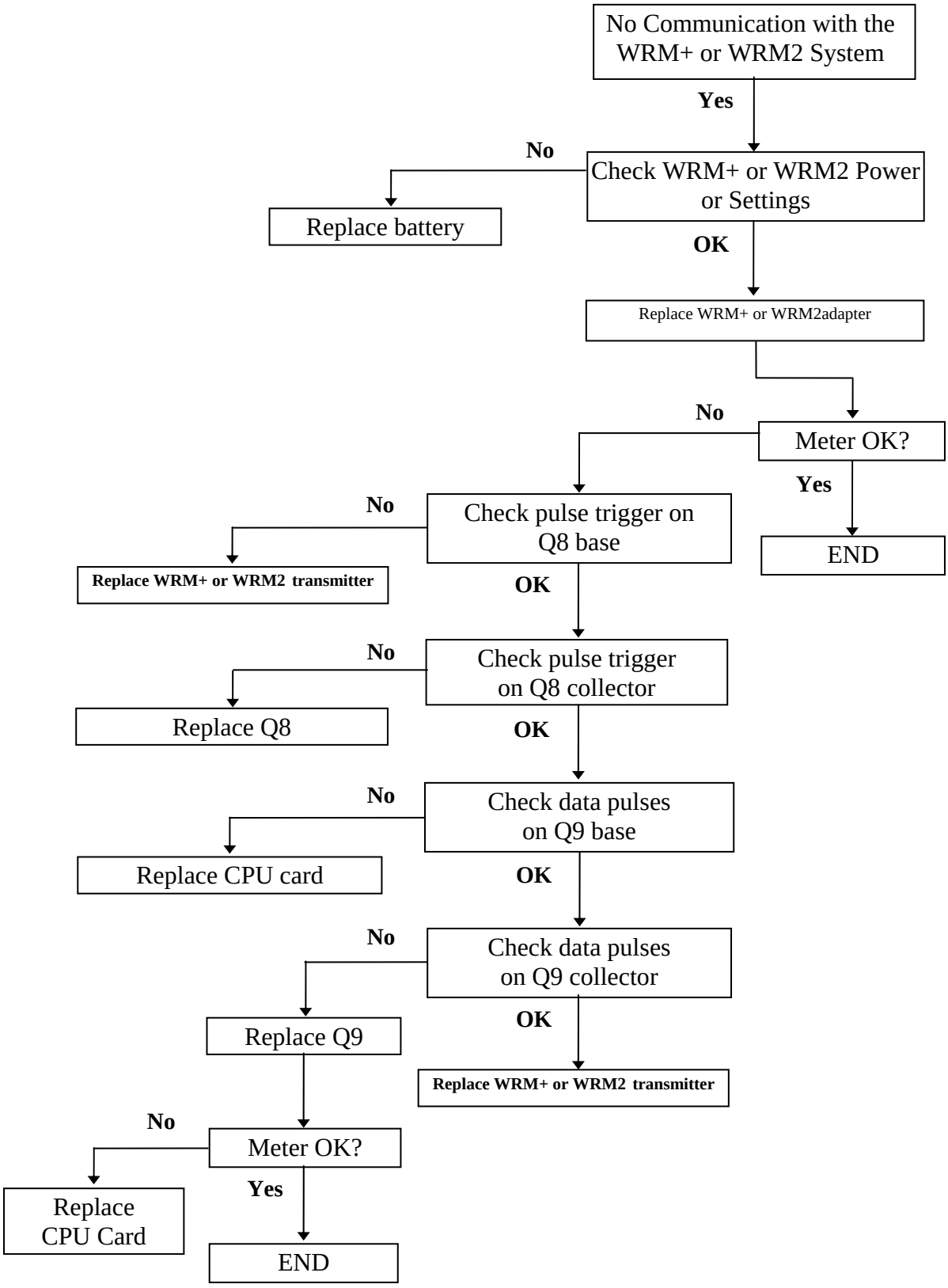
10.4. Display turns off or is incorrect



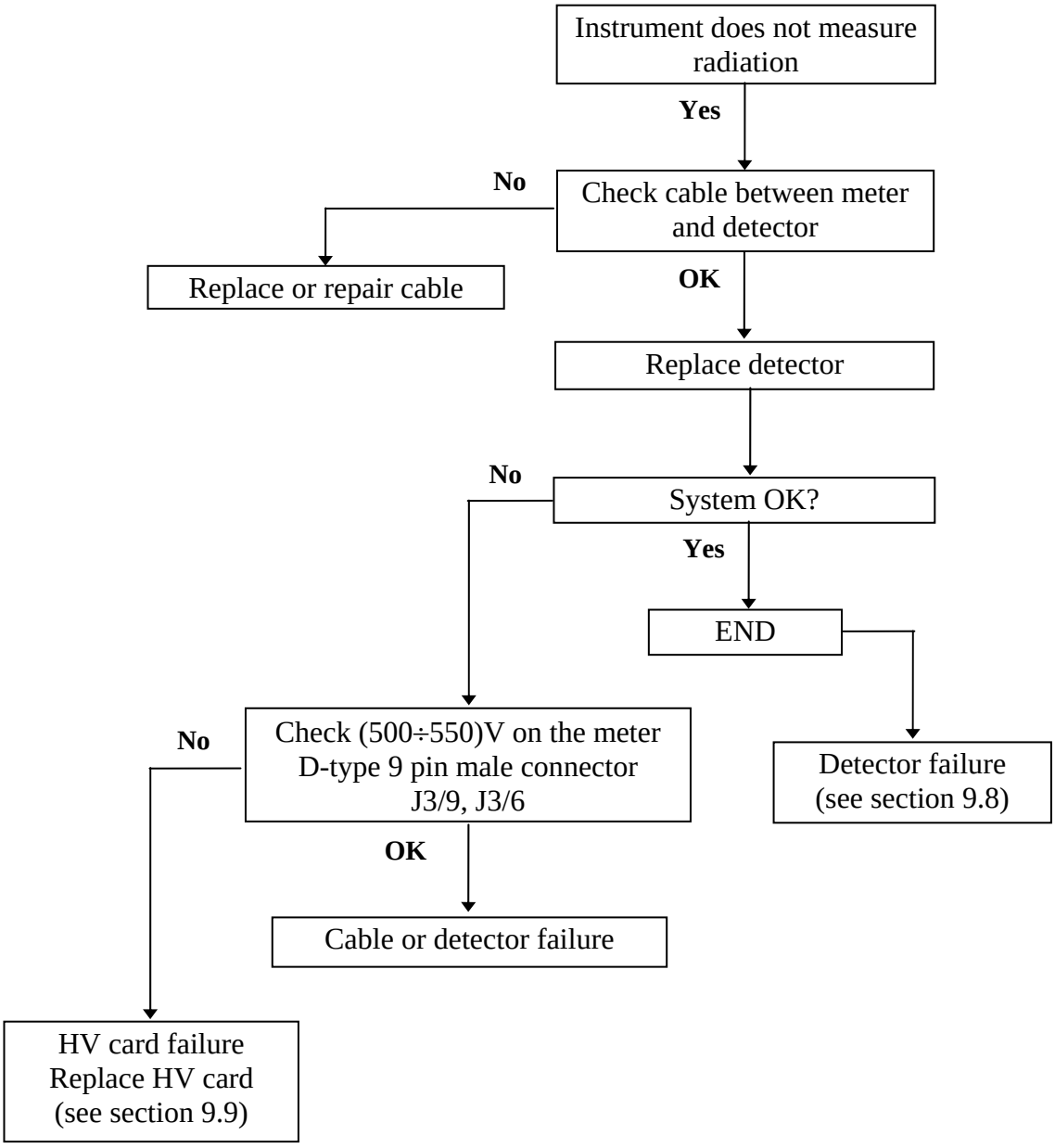
10.5. Speaker does not alarm



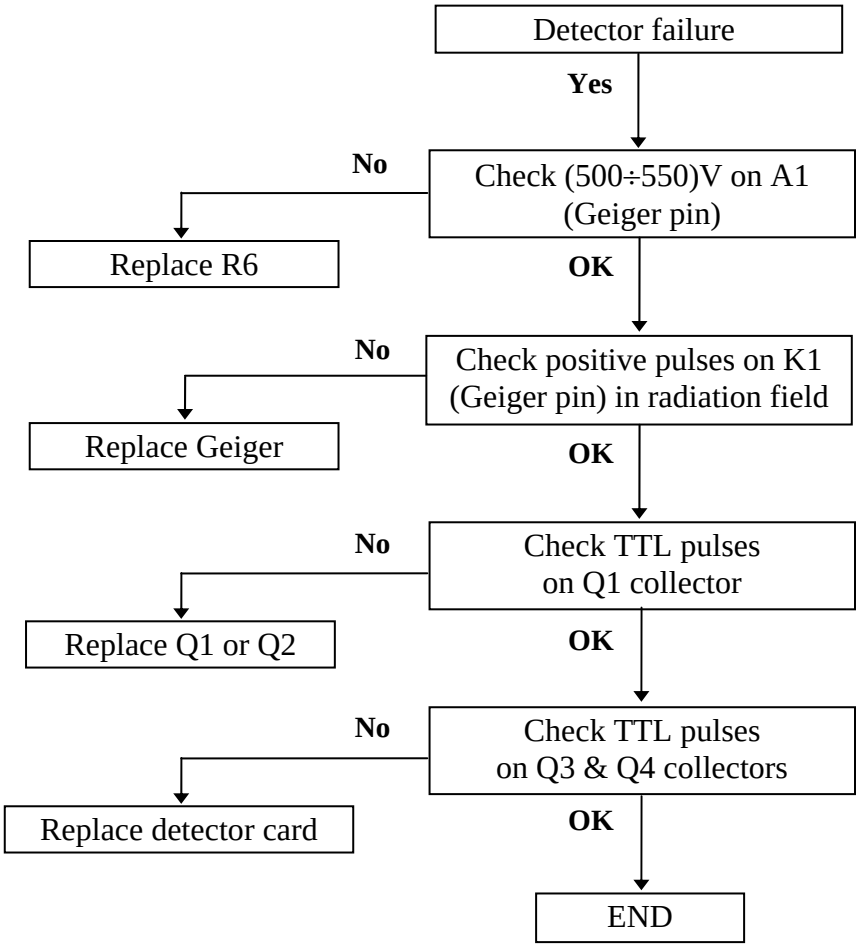
10.6. No communication with the WRM system



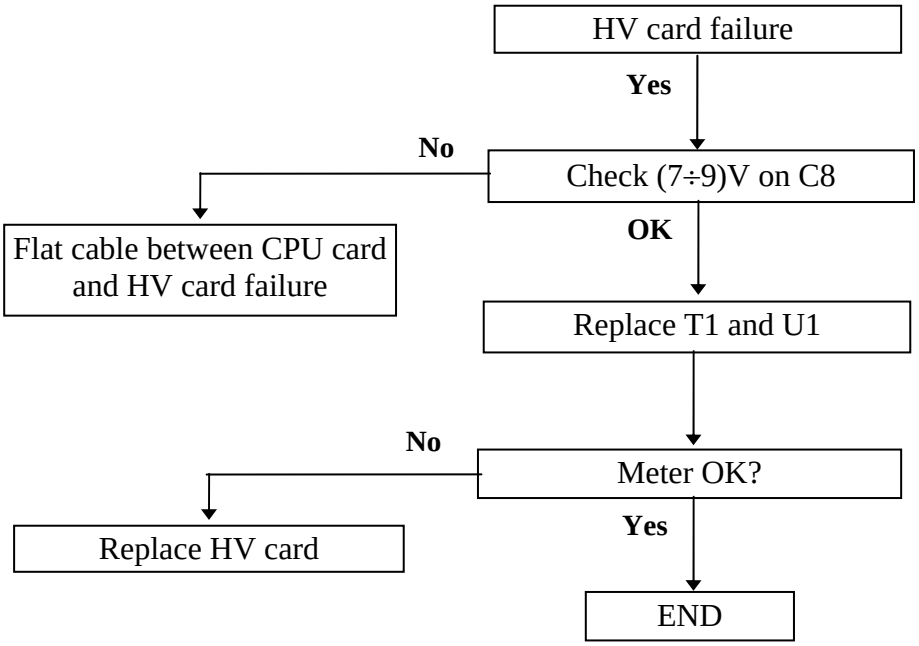
10.7. Instrument does not measure radiation



10.8. Detector failure

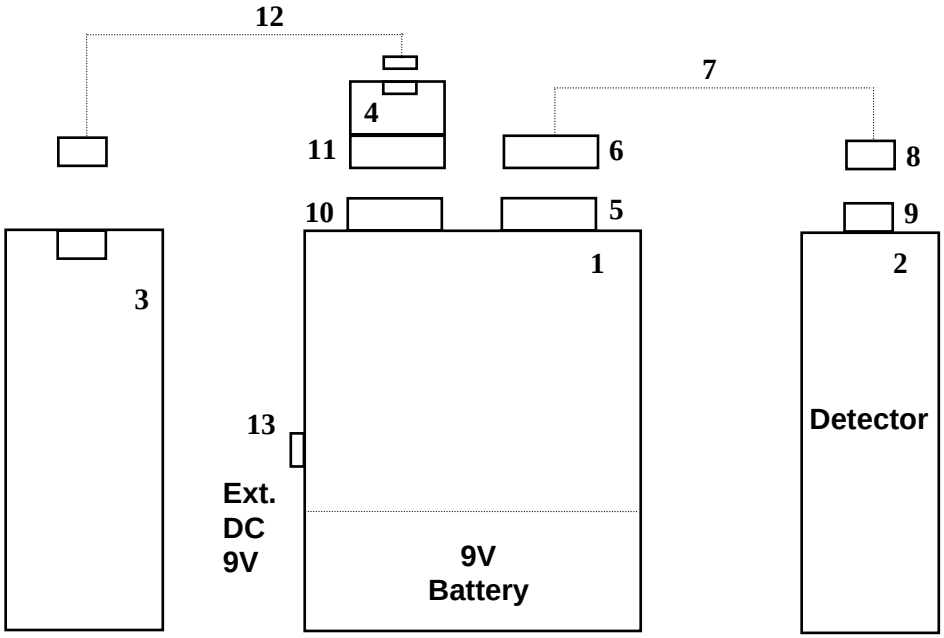


10.9. HV card failure



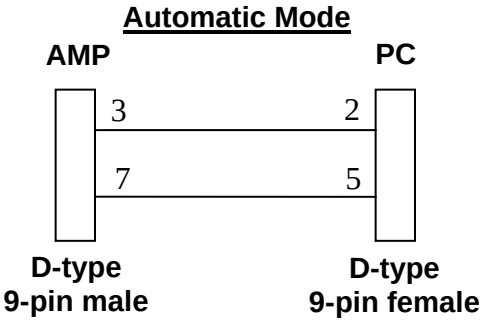
Appendix 1

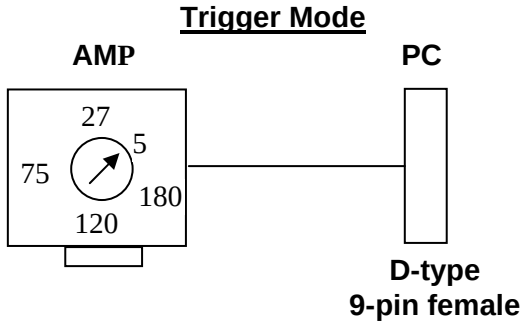
The AMP System Parts List

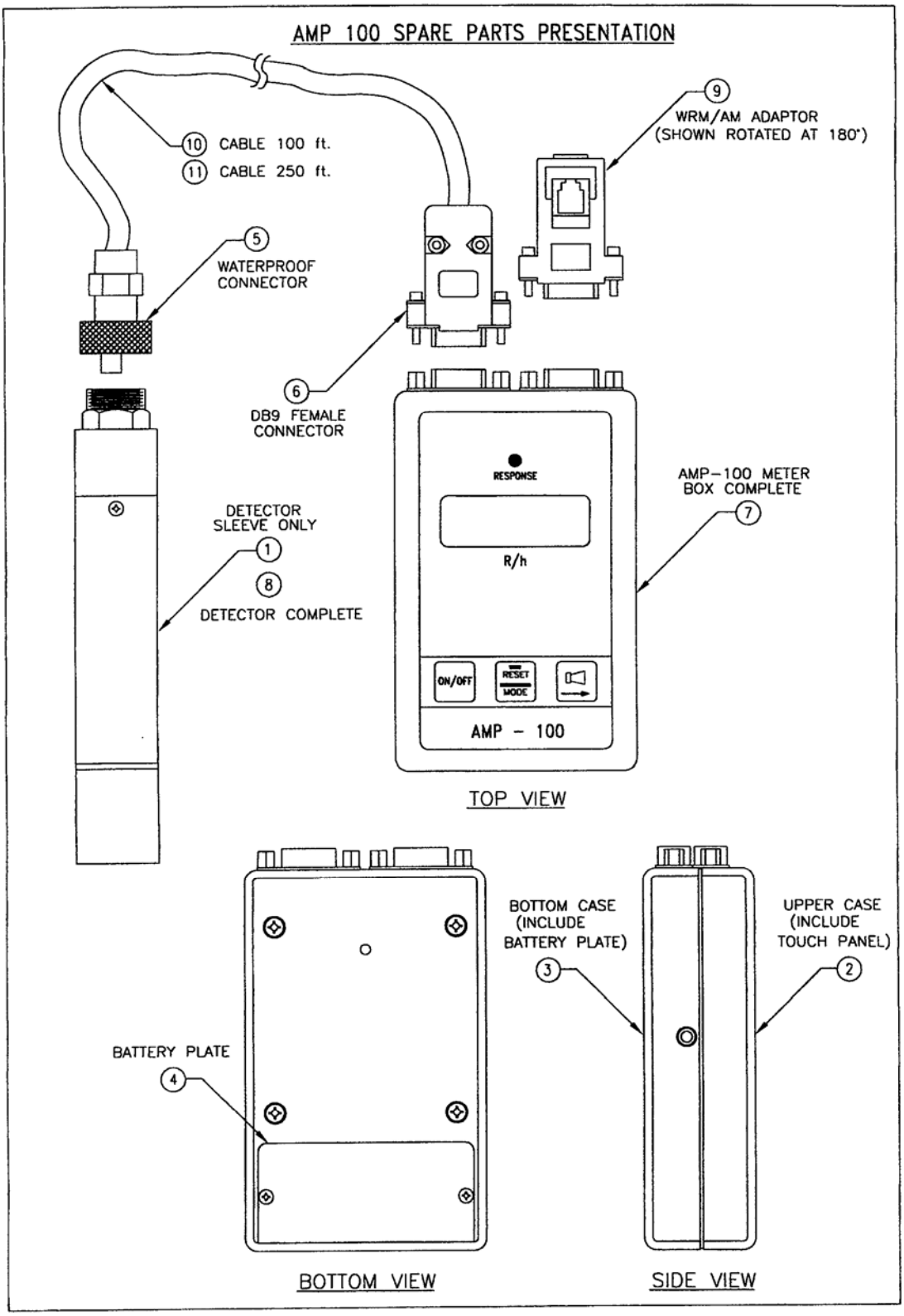


1 - Meter
2 - Detector
3 - WRM transmitter (optional)
4 - WRM adapter
5 - D-type male connector
6 - D-type female connector

7 - 4-wire shielded cable
8 - Ikelite connector II9104.15 cable
9 - Ikelite connector II9104.55 (panel)
10 - D-type female connector
11 - D-type male connector
12 - 4-wire telephone cable
13 - Audio connector 3.5 mm (external DC)
14 - AMP to PC comm. cable (automatic mode)
15 - AMP to PC comm. cable (trigger mode)
16 - RS-232 Connector RTM-9128



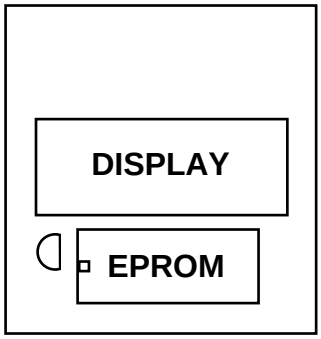




Appendix 2

Instructions for EPROM Replacement

1. Disconnect the detector cable from the meter.
2. Disconnect the communication cable from the meter.
3. Loosen the two capture screws on the battery compartment cover, take out the battery.
4. Loosen the four screws on the rear panel, turn and separate the meter's parts.
5. Disconnect the touch panel flat cable (5-pin).
6. Loosen the two screws adjusting the PC #1938 board (located above the flat-cable connector).
7. Remove the EPROM.
8. Insert a new EPROM.
9. ***Take care to insert the EPROM in the correct direction***.



PC 1938

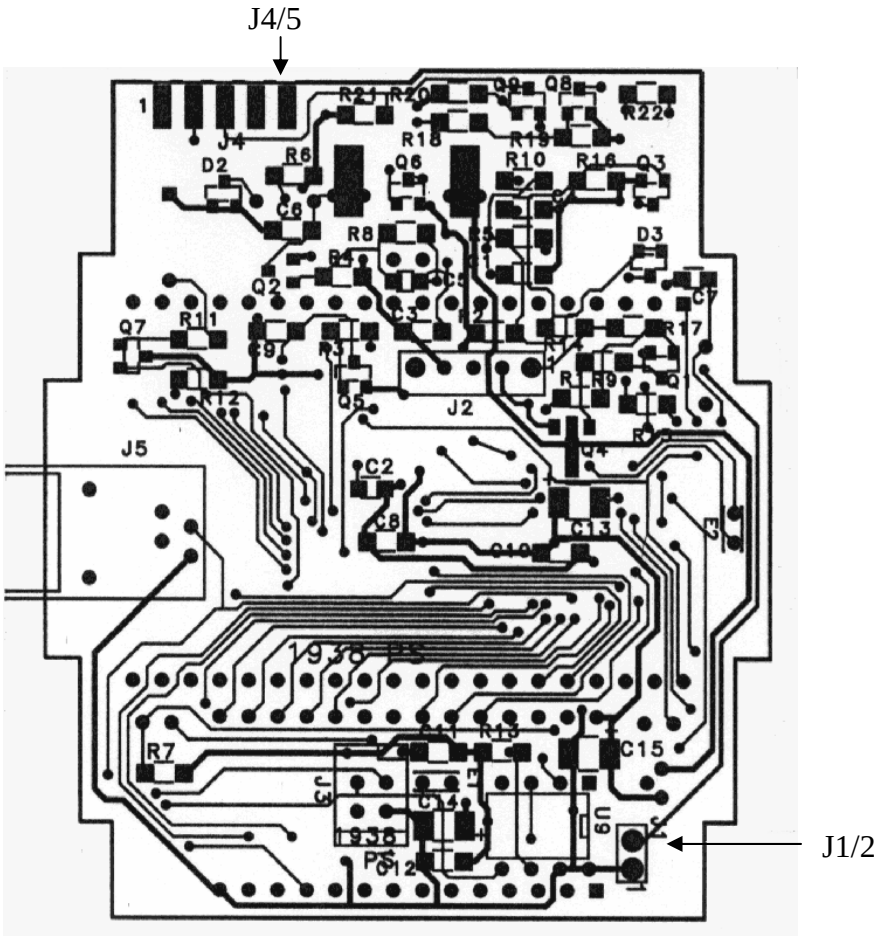
10. Assemble the meter following steps 1 to 6 in the reverse order.

Appendix 3

External Power Supply From DDC-16/AM-16 or WRM Transmitter

In order to enable direct power supply from the DDC-16/AM-16 or WRM Transmitter to the AMP, the following change has to be performed on the CPU Board - PC #1938.

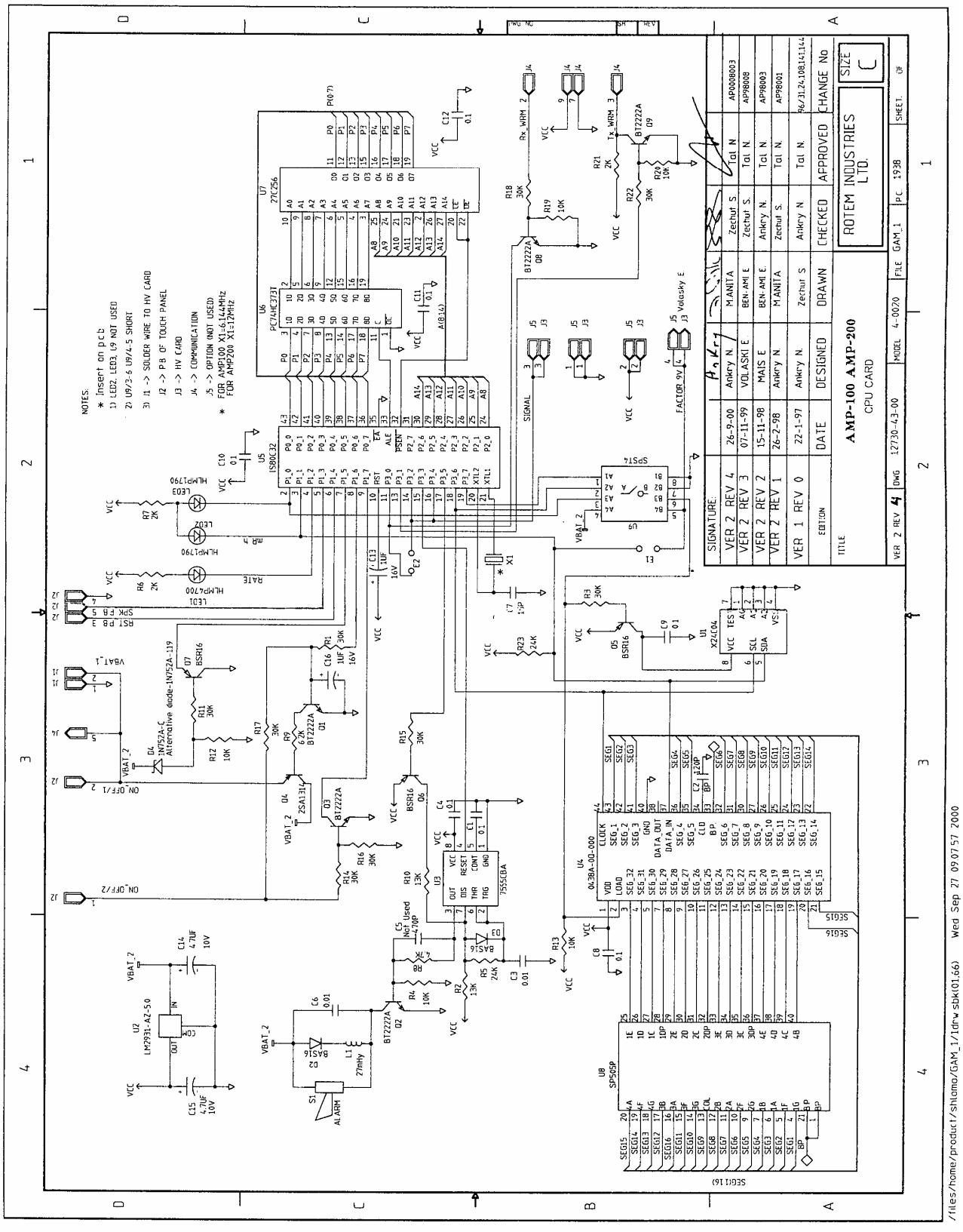
- Open the AMP case.
- Solder a wire between J1/2 and J4/5 on the CPU board, on the print side, as shown in the following figure:

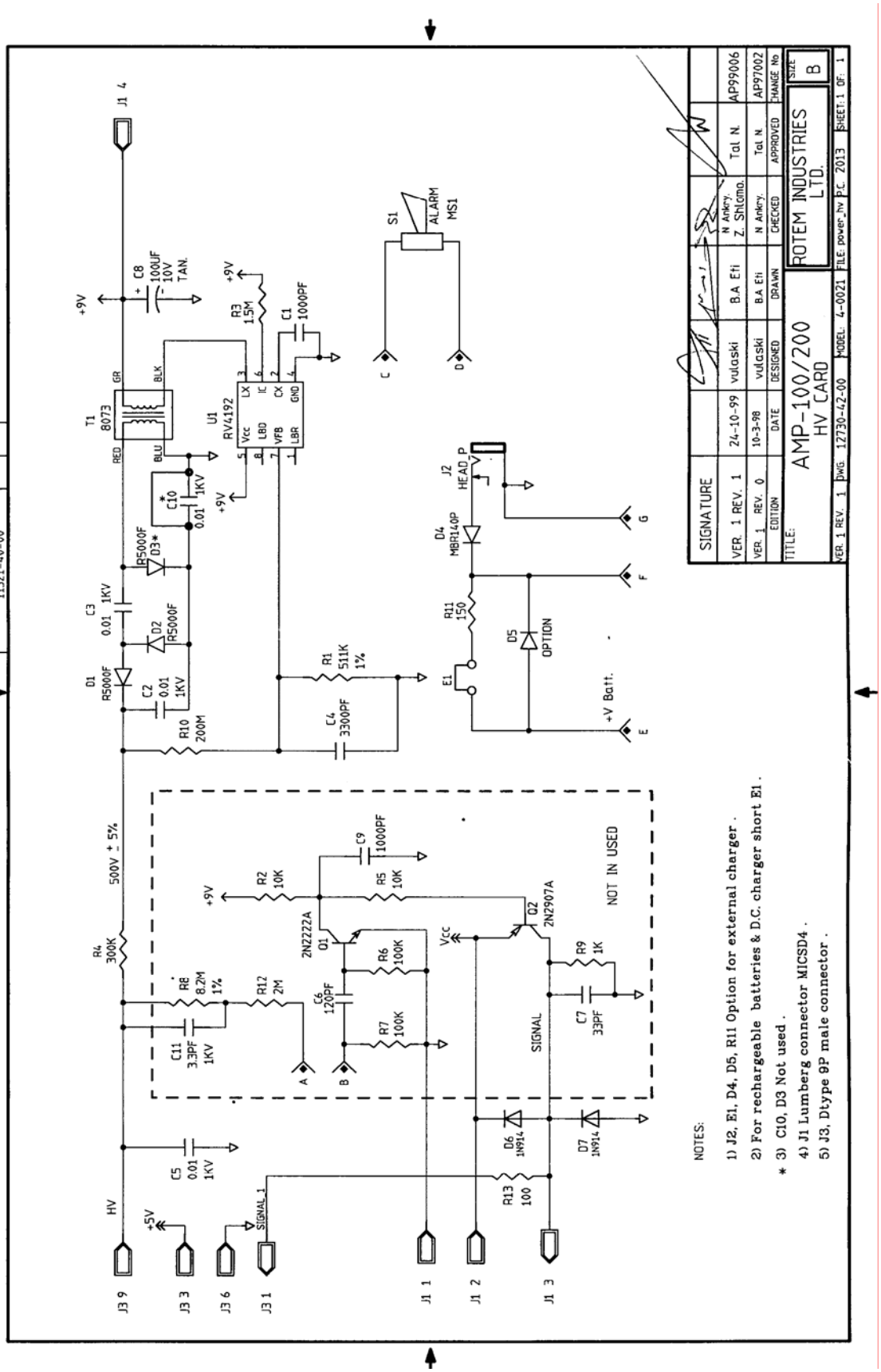


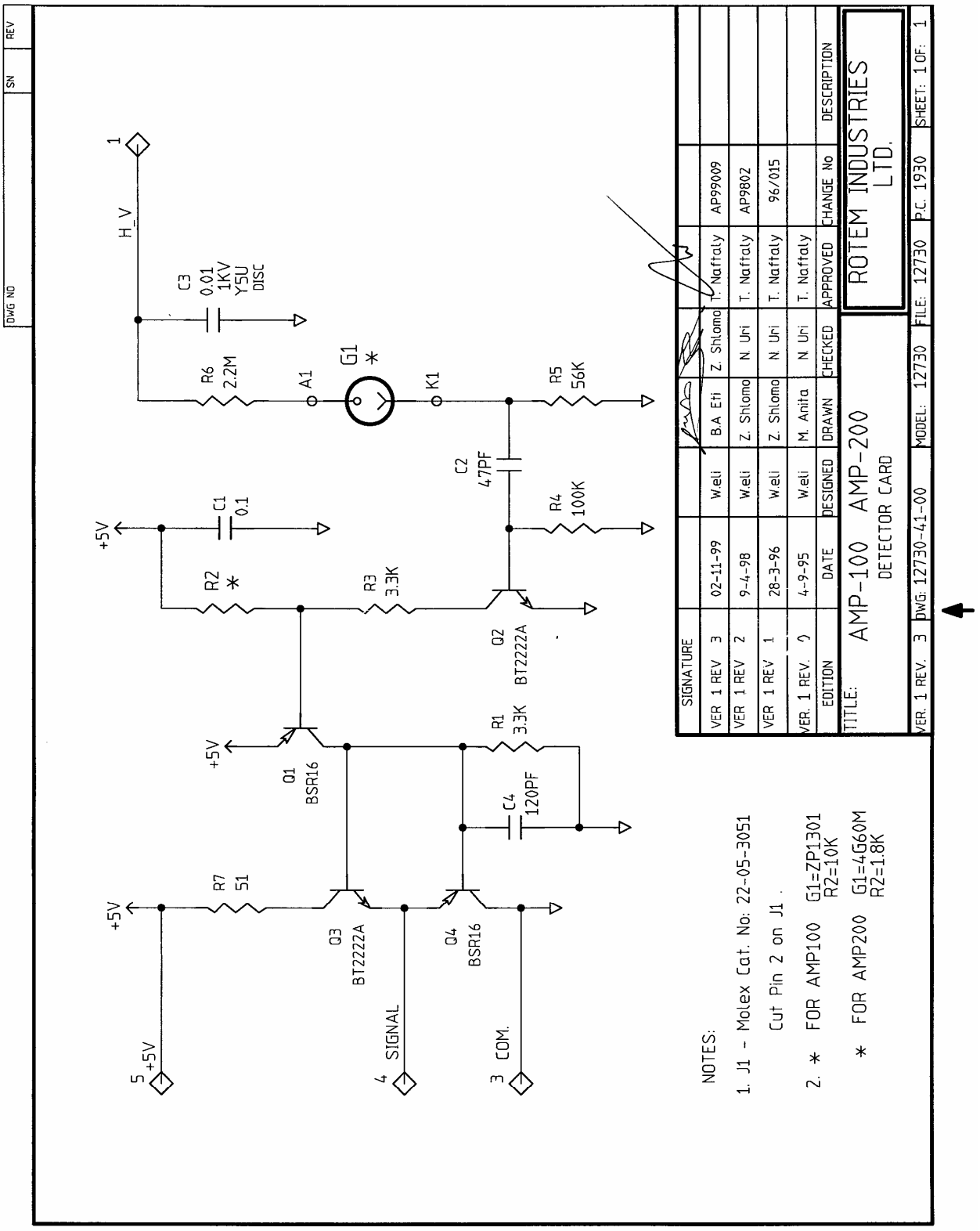
Note: This change has to be performed on the instruments with serial # 5095*** and CPU board version #1.0.
There is no need to perform this change on instruments serial # 5097*** and 5098***.

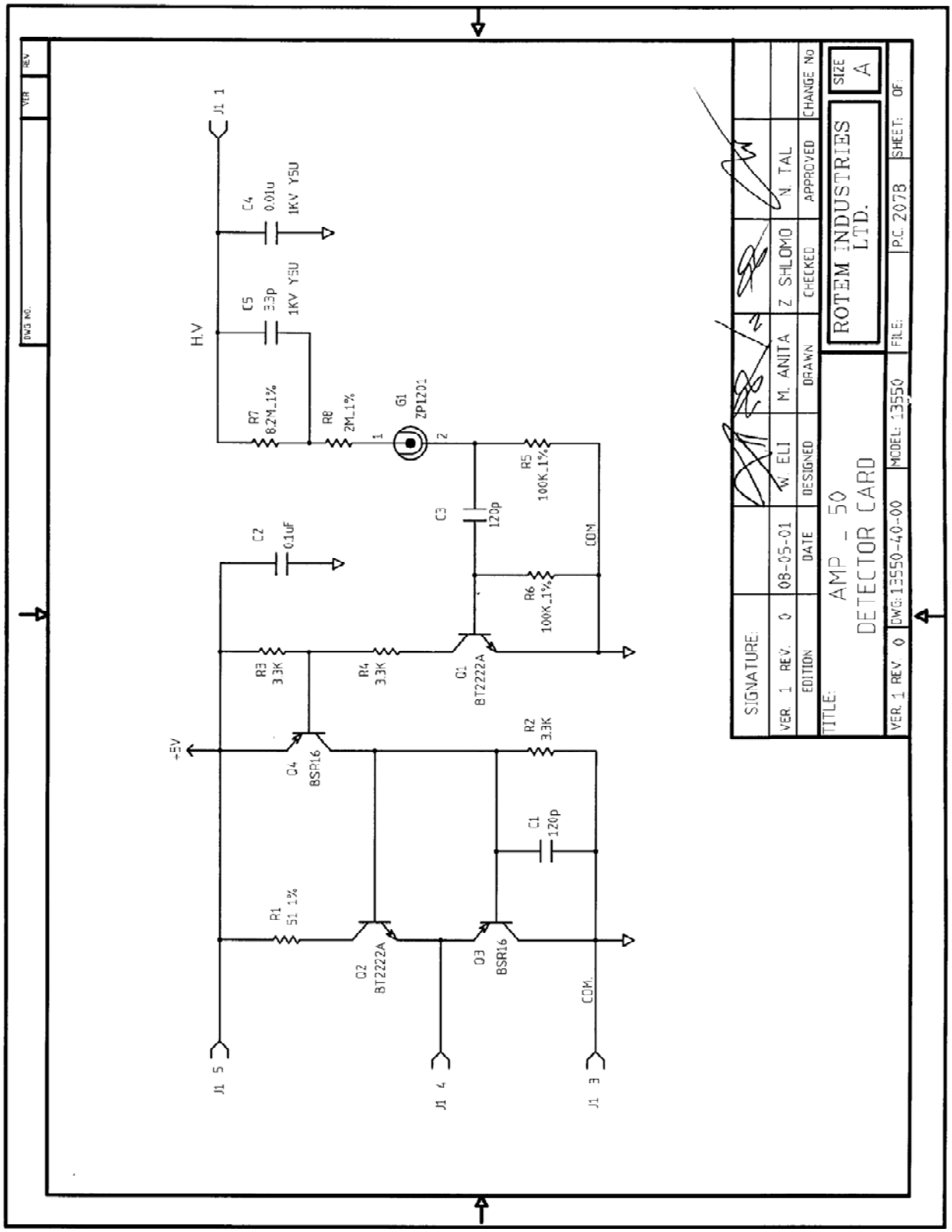
Appendix 4

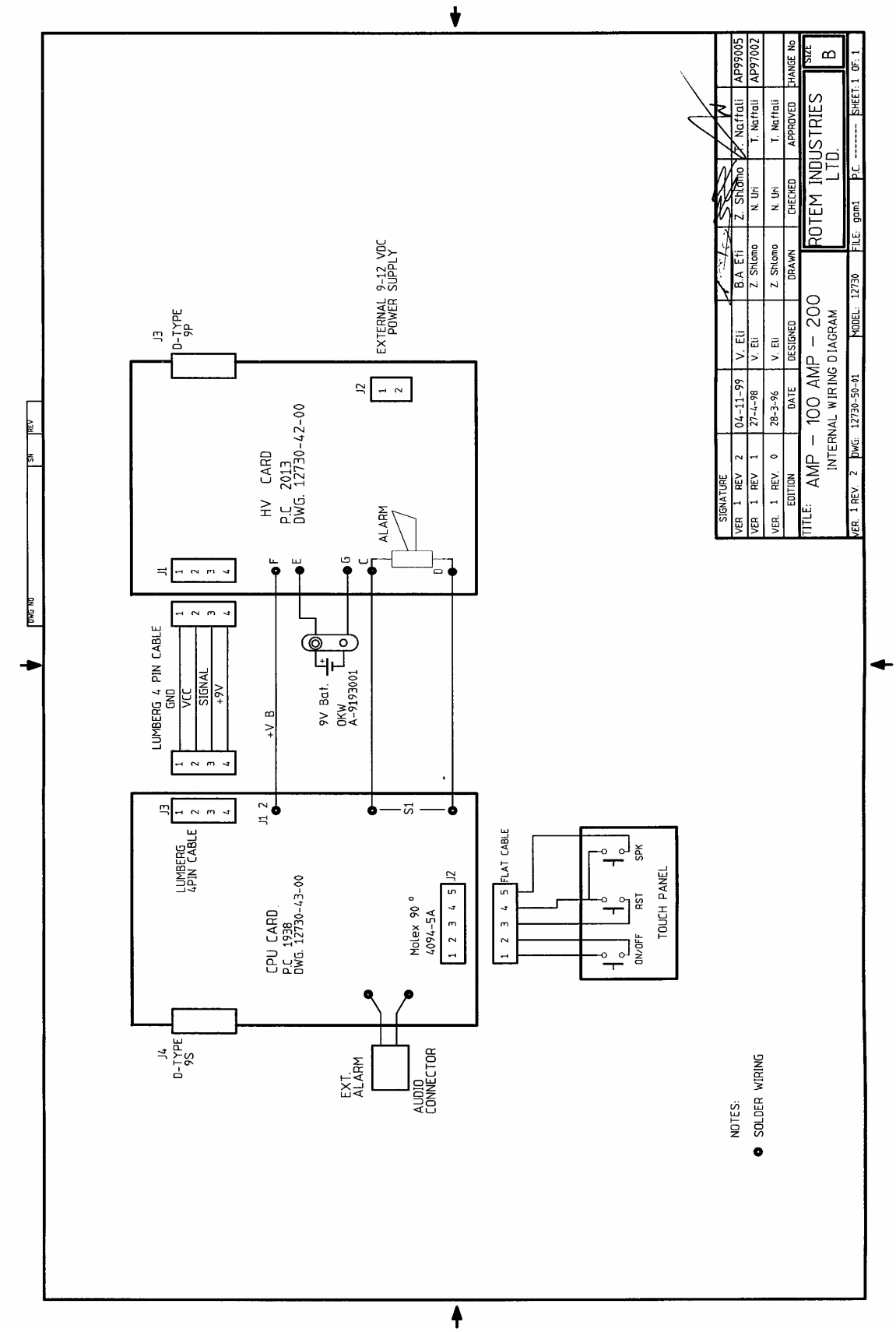
AMP-50, AMP-100, AMP-200

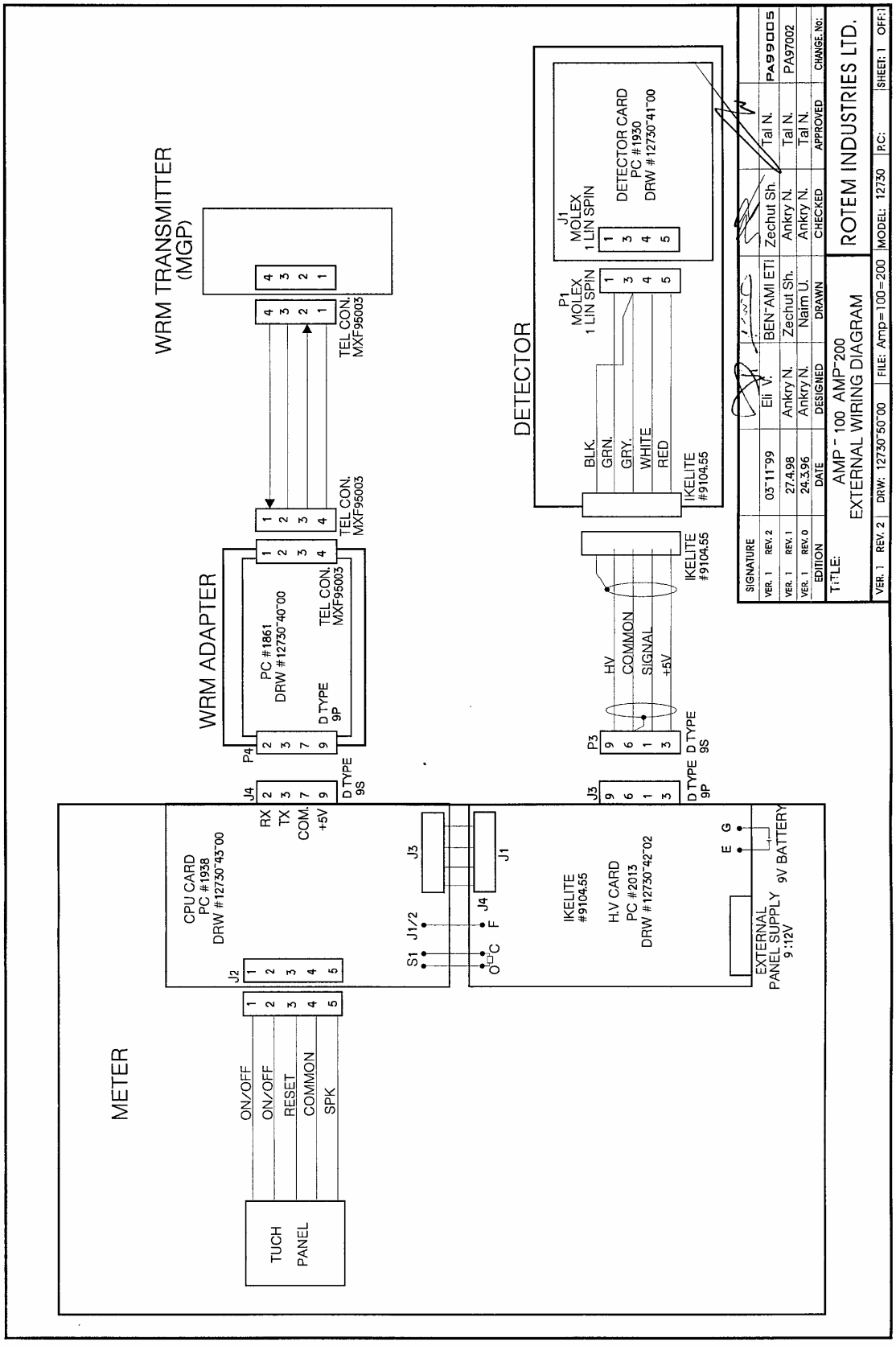


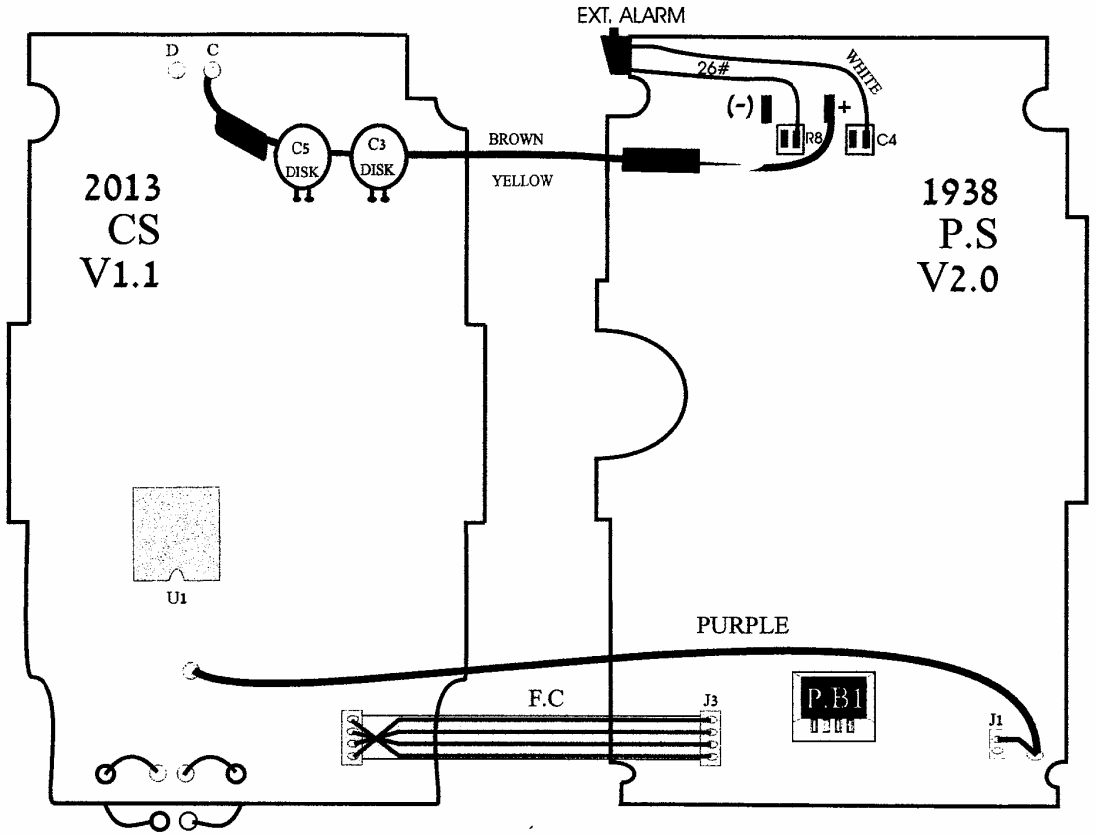












SIGNATURE						
VER: 1 REV: 2	28-03-00	PINTER Z.	BEN_AMI E.	ZECHUT S.	MAZOR Z.	Ap99007
VER: 1 REV: 1	1-5-99	PINTER Z.	BEN_AMI E.	ZECHUT S.	MAZOR Z.	AP99003
VER: 1 REV: 0	28-4-99	PINTER Z.	BEN_AMI E.	ZECHUT S.	MAZOR Z.	
EDITION	DATE	DESIGNED	DRAWN	CHECKED	APPROVED	CHANGE. No:

TITLE: **AMP - 100 AMP - 200**
GRAPHIC - WIRING

ROTEM INDUSTRIES LTD.

VER. 1 REV. 2 | DRW:12730-50-02 | FILE: amp_100-200 | MODEL: 12730 | P.C: ==== | SHEET: | OFF: