Dose Rate Meter 6150AD: Probe Connector
Technical Manual

Contents

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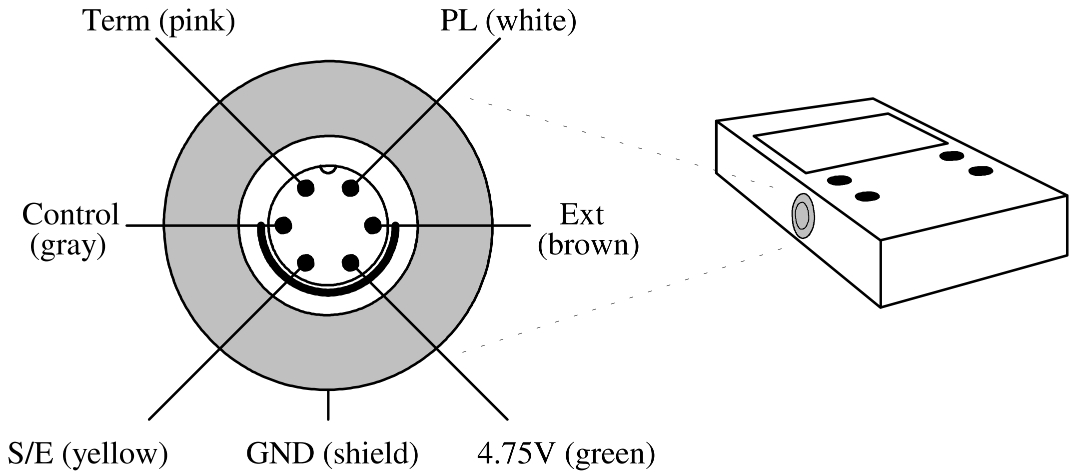
1. General

As implied by its name, the 6150AD probe connector serves for connecting external probes to the 6150AD. However, the probe connector offers additional features, especially to read the 6150AD instrument by a computer (which is used e.g. by the Automess Dose Rate Acquisition Systems DES11/12/13). This manual shall provide information to 6150AD users how to use the output signals for own applications. Throughout this manual it is assumed that the reader is familiar with the operation of the 6150AD series instruments.

Pin assignment of the probe connector is as follows:



Contrary to e.g. sub-D connectors the pins are not numbered on the body of the connector due to lack of space. Instead the six pins were given the names indicated above (which are names taken from the schematics of the 6150AD). All further discussions of the signals will refer to these names. The colours in parentheses are those of the wires in the Automess standard probe cable. So the easiest way to access the signals for testing or for connecting some user equipment would probably be to cut a standard probe cable into two equally sized pieces, which would give two test cables at a time.

The purpose of the signals is listed below an will be discussed in more detail later:

GND — Ground potential. Note that there is no pin for GND. The cable shield serves both as shield and as ground connection. The aluminium housing of the 6150AD and the AD probes is electrically equal to GND.

4.75V — Supply voltage for external probes. Identical to supply of 6150AD internal electronics.

PL, S/E — Signals needed for serial readout of probe data (probe type and calibration parameters). PL (»parallel load«) is an output used to load these data into a shift register. S/E (»Senden/Empfangen« = »transmit/receive«) is a tri-state bidirectional line used to clock and read the shift register.

Ext — Pulse input from external probes. External pulses will only be counted if an external probe was recognized through lines PL and S/E.

Term — Serial output similar to RS232 (»terminal«) for a periodic readout of dose rate by a computer.

Control — Output to switch between the two GM counters in the telescopic probe AD-t.

External probes require all lines except Control and Term. The two detector probe AD-t additionally requires the Control line. Term is not required by any probe.

Lines Term, Control, and 4.75V are data and power outputs, respectively. They will be discussed in the next section »Data Outputs«. Lines PL, S/E, and Ext can be regarded as data inputs when using the 6150AD as a ratemeter for external probes. Data inputs will be covered in the appendix »Data Inputs«. However, this appendix contains confidential information and will be added to this document only on special request.

2. Data Outputs

2.1 »Term«

The 6150AD calculates a new dose rate value approximately every second and outputs this value as a string of characters through the Term line. This can be used to read the 6150AD by a computer through a serial RS232 interface. Output characters are binary and thereby not suitable to be viewed directly on a serial terminal or printer. The time between two subsequent output strings may vary slightly due to varying microprocessor load. Nevertheless, counting strings may also be used for time measurement, since the average time between two strings is exactly equal to 1.049 seconds (2^{20} µs) as derived from the internal quartz.

Term acts purely as a transmitter, there is no way to feed data into the 6150AD or to request a repeat in case of transmission errors. Also, there are no handshake signals to control the Term output.

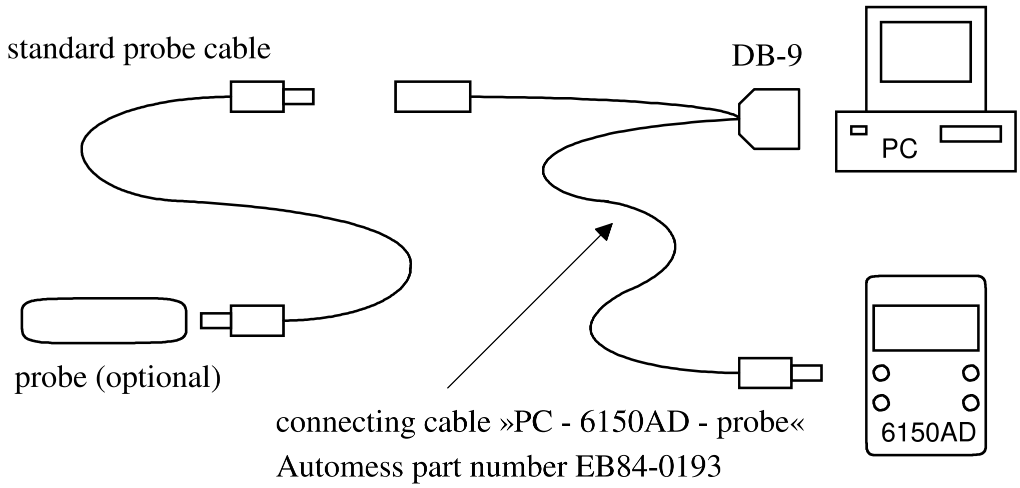
2.1.1 Hardware Characteristics

The Term line is a CMOS gate output with an impedance of several hundred Ohms. Its driving capability is therefore at least equivalent to RS232 interfaces. Nevertheless, cables should be restricted to maximum lengths as with RS232 interfaces (15m at 9600Bd, 30m at 4800Bd, etc.). Contrary to RS232 lines the Term output is not short circuit proof and swings between GND and 4.75V because there is no negative voltage available in the 6150AD.

	Term output	RS232 output specs	RS232 input specs
logical »0«:	+4.75V	+5...+15V	> +3V
logical »1« (marking state):	GND	-5...-15V	< -3V

Although the positive Term level of 4.75V does not completely meet the RS232 specification of +5V minimum, it should be properly recognized by any RS232 device, since any voltage above +3V has to be recognized as the positive level. The GND level however lies in the undefined range from -3V...+3V. Fortunately almost all RS232 devices recognize GND level as the negative level. So far we only met one exception in a many years old IBM serial/parallel adapter using a 75154 input buffer. This input buffer changes and stores its state only if its input level is outside the -3V...+3V range. If this rare case should occur, the remedy would be to feed Term through a 1 nF capacitor into the RS232 interface. This capacitor will differentiate GND to +4.75V and +4.75V to GND transitions to positive and negative spikes, which will be recognized and stored by the 75154.

A typical setup to read the 6150AD by a PC (optionally with a probe connected) would be:



The cable EB84-0193 is basically a probe extension cable with a »T« connection making the GND and Term signals available at the 9 pin sub-D connector.

2.1.2 Software Characteristics

Interface settings are

4800 Bd (9600 Bd for special 6150AD1-BiZa version)
8 data bits
no parity
1 stop bit

The character string sent approximately every second consists of the following six bytes:

1. STX (02H) as the start of text character
2. type of detector/6150AD
3. dose rate mantissa (low byte)
4. dose rate mantissa (high byte)
5. dose rate exponent
6. block check character

The second byte (type of detector/6150AD) contains:

Bit 0-5:	detector in use:	0 = probe 6150AD-0
		7 = probe 6150AD-b
		15 = probe 6150AD-15
		17 = probe 6150AD-17
		18 = probe 6150AD-18
		19 = probe 6150AD-19
		20 = 6150AD internal tube
		21 = probe 6150AD-t, low range tube
		22 = probe 6150AD-t, high range tube
Bit 6:	type of internal tube:	0 = ZP1200 (6150AD2/4/6)
		1 = ZP1310 (6150AD1/3/5)
Bit 7:	measuring quantity:	1 = 6150AD »/E« model (6150ADx/E)
		0 = other (6150ADx or 6150ADx/H)

Bytes 3-5 contain the current dose rate reading in floating point notation, where bytes 3 and 4 contain the 16 bit positive mantissa and byte 5 is the signed (-128...+127) 2-based exponent. The unit is µSv/h (pulses per second for pulse rate indicating probes like 6150AD-k, AD-17, AD-19).

Byte 6 is the XOR (exclusive OR) of Bytes 2-5 and is intended to be used as a block check character to detect transmission errors.

The following QBASIC program gives an example how to decode the string:

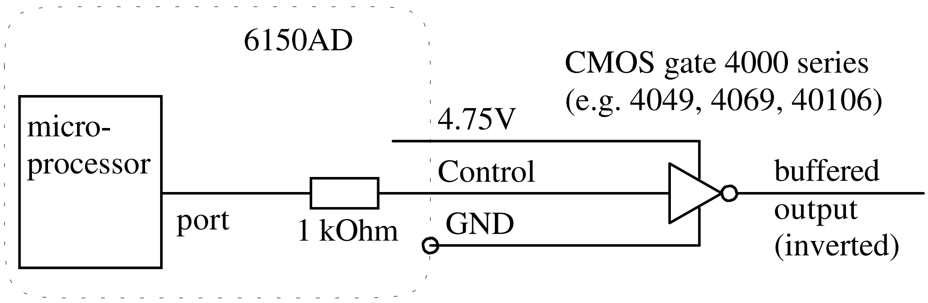
```
'       Variable Types
DEFINT A-W
DEFSNG X-Z
'       Constant Expressions
CONST STX = 2
CONST DEVERR = 57
' ---------------------------------------------------------------------
'       Main Program
' ---------------------------------------------------------------------
'       Open COM: 4800 Bd, no parity, 8 data bits, 1 stop, no handshake
OPEN "com1:4800,n,8,1,rs,cs,ds,cd" FOR INPUT AS #1
ON ERROR GOTO RecvErr
'       Main Loop: read and decode string (6 characters including STX),
'                  display result, exit on any key.
MainLoop:
DO
  WHILE ASC(INPUT$(1, #1)) <> STX: WEND 'wait for STX
  sonde = ASC(INPUT$(1, #1))            'type of detector/6150AD
  bc = sonde
  mantlo = ASC(INPUT$(1, #1))           'low order mantissa
  bc = bc XOR mantlo
  manthi = ASC(INPUT$(1, #1))           'high order mantissa
  bc = bc XOR manthi
  expon = ASC(INPUT$(1, #1))            'exponent
  bc = bc XOR expon
  IF expon > 127 THEN expon = expon - 256
  bc = bc XOR ASC(INPUT$(1, #1))        'block check
  IF bc <> 0 THEN ERROR DEVERR          'block check error
  mant = manthi * 256 + mantlo          '16 bit mantissa
  xdl = mant * 2 ^ (expon - 15)         'dose rate as floating point number
  GOSUB GetProbe                        'set ger$, det$ and unit$
  PRINT TIME$; " Device: 6150"; ger$; "  Detector: "; det$;
  PRINT USING "  Reading=########.### "; xdl;
  PRINT unit$
LOOP WHILE LEN(INKEY$) = 0              'exit on any key
PRINT "End."
END
' ---------------------------------------------------------------------
'       set ger$ / det$ / unit$ according to 'sonde'
' ---------------------------------------------------------------------
GetProbe:
  flag$ = ""
  IF sonde >= 128 THEN flag$ = "/E": sonde = sonde - 128
  ger$ = "AD2/4/6" + flag$
  IF sonde >= 64 THEN ger$ = "AD1/3/5" + flag$: sonde = sonde - 64
  det$ = "unknown"
  unit$ = "µSv/h"
  SELECT CASE sonde
    CASE 0
      det$ = "Probe AD-0"
      unit$ = "cps"
    CASE 7
      det$ = "Probe AD-b"
    CASE 15
      det$ = "Probe AD-15"
    CASE 17
```

```
      det$ = "Probe AD-17"
      unit$ = "cps"
    CASE 18
      det$ = "Probe AD-18"
    CASE 19
      det$ = "Probe AD-19"
      unit$ = "cps"
    CASE 20
      det$ = "internal GM"
    CASE 21
      det$ = "AD-t low DR"
    CASE 22
      det$ = "AD-t high DR"
  END SELECT
RETURN
' ---------------------------------------------------------------------
'       Handler for transmission errors
' ---------------------------------------------------------------------
RecvErr:
IF ERR = DEVERR THEN PRINT TIME$; " Transmission Error": RESUME MainLoop
ON ERROR GOTO 0
```

2.2 »Control«

This output switches between the two GM counters in the telescopic probe AD-t, where Control = high (4.75V) selects the low dose rate GM counter, and Control = low (GND) selects the high dose rate GM counter. If any other or no probe is connected, Control will always be high.

Certain software versions of the 6150AD (e.g., the Swedish version V-36.04) make additional use of the Control output: With the AD-t probe, Control will operate as described above. With any other or no probe the Control output will signal dose rate alarm: Control = high indicates that dose rate alarm is off, and Control = low indicates that dose rate alarm is on. This allows triggering of external alarming devices. However, one has to consider that the Control output can only drive very small loads due to its internal structure:

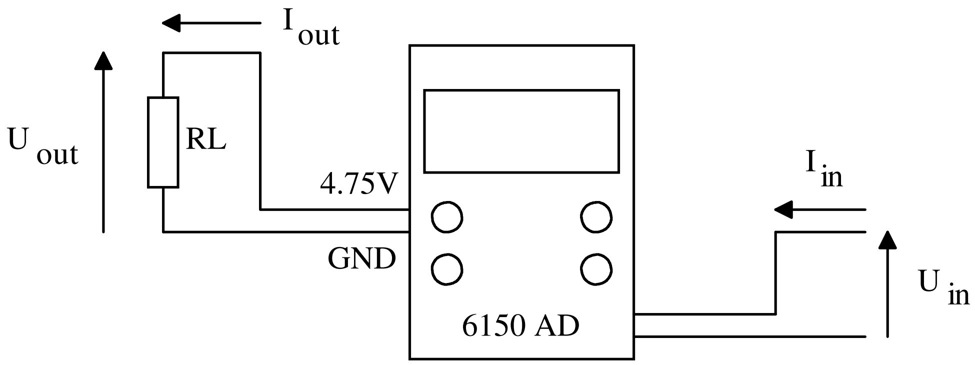


The microprocessor port can sink only a few mA and can source almost no current, because the high state is achieved through a weak pull-up resistor of 10-100 kOhms depending on the manufacturer of the microprocessor. The Control output can therefore only drive high impedance low capacity inputs like CMOS gates as shown in the drawing above. Such buffering is strongly recommended before connecting some external device.

2.3 4.75V

This section describes line and load characteristics of the 4.75V output which may be used to supply external devices. As will be shown, up to 50 mA may be drawn from this output. This seems a reasonable limit when keeping in mind that battery life with an external device should still amount to several hours.

The 4.75V output voltage is generated inside the 6150AD out of the battery voltage by means of a switched regulator. It is individually tested in serial production to be in the range of 4.65V to 4.90V with a typical value of 4.75V (at an input battery voltage of 7.0V).



	no load	RL = 82.5 Ohm			
U_{in} V	U_{out} V	I_{in} mA	U_{out} V	I_{out} mA	efficiency %
5.0	4.782	52.0	4.320	52.4	87
5.5	4.785	55.0	4.651	56.4	87
6.0	4.789	52.5	4.683	56.8	84
7.0	4.795	46.5	4.724	57.3	83
8.0	4.801	42.0	4.744	57.5	81
9.0	4.807	38.0	4.758	57.7	80
9.5	4.810	37.0	4.765	57.8	78

Note that at input battery voltages below 5.5 volts the 6150AD will issue battery warning.

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End of »Data Outputs« section.

Appendix with »Data Inputs« section is only supplied on special request.

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