

• **Extended Test Program**
(PM 6666)

To understand this description, you must understand the function of the I²C-bus. This is described under "Micro-Controller and I²C-bus" in the chapter on "Functional Description".

With the aid of an oscilloscope, all the test signals can be examined and followed through the circuitry. Oscilloscope settings, see page 67.

- Switch off the counter.
- Move the test jumper on the basic board to the TEST position.
- Switch on the counter. The display shall remain blank.

The relays of the counter are now affected by test pulses, which causes the counter to buzz. If the sound is disturbing, turn it off by moving the test jumper on the basic board back to the NORM position.

As the jumper was in the TEST position when the counter was switched on, the built-in "Extended Test Program" controls the processor of the counter. This program contains instructions which order the processor to generate and send test signals via its own out-ports, and also sequences of test signals on the I²C-bus.

Slaves connected to the I²C-bus and addressed by the test signals shall acknowledge the addressing. Notice that the MTCXO oscillator and the GPIB interface are options and thus will acknowledge the addressing only if they are installed.

Many functions in the input amplifiers are controlled by I/O circuits connected to the I²C-bus. To check these circuits, test data is sent from the processor to the circuits via the I²C-bus. The reply signals from the I/O circuits form a settled test-signal pattern which can be verified.

The time of the complete test sequence is 44 ms and the sequence is renewed after further 6 ms. The sequence contains 16 parts, each with a duration time of 2.7 ms, see figure 72.

These 16 sequence parts are similar, except for one section of each part in which data to the I/O circuits are located. These sections contain relay data and are addressed to that particular circuit which controls the relays. This relay data causes the counter to buzz while running the "Extended Test Program". By moving the test jumper to the NORM position (to quieten the relays) these sections are removed from the sequence parts, without altering anything else in the sequence.

After moving the test jumper to the NORM position the sequence part is shortened by 0.3 ms, the duration time will be 2.4 ms and the time of the complete sequence 39 ms.

After the test communication from the out-ports of the processor, four addressings to the slaves are sent via the I²C-bus, see figure 72. These addressings are not followed by any data. After that, four new addressings are sent, each one followed by one byte of data. This data is changed between the 16 sequence parts.

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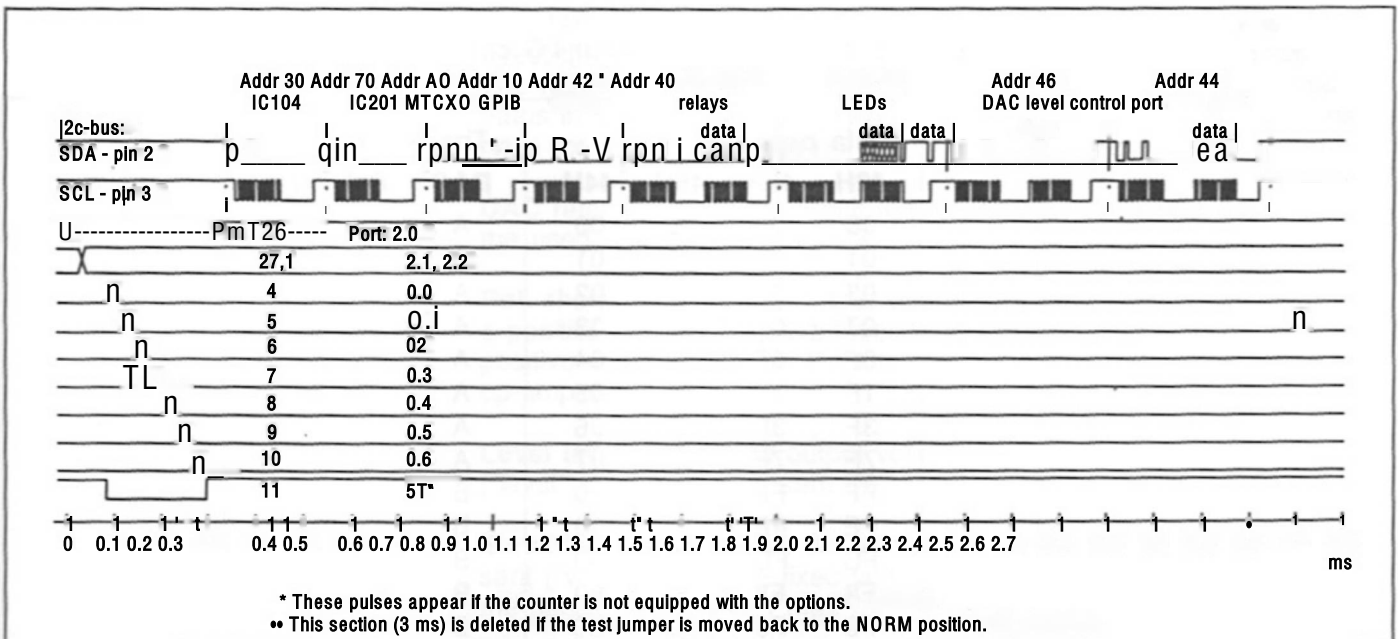


Figure 72. Test-signal pattern (PM 6666).

"Pin" in figure 72 gives the pin numbers of the processor.

The levels of port 2.2 and port 2.1 are fixed during the cycle periods of 1.2 ms. Between these periods they change their levels in binary up-counting sequences:

00 01 10 11 00 and so on

Port 2.1 is changed between every period. Port 2.2 is changed between every other period.

Signal sequence:

Port	2.0	30 ps negative pulse
Port	2.1 and 2.2	binary up-counting
Port	0.0	30 ps positive pulse - port 0.7 goes low
Port	0.1	30 ps positive pulse
Port	0.2	30 ps positive pulse
Port	0.3	30 ps positive pulse
Port	0.4	30 ps positive pulse
Port	0.5	30 ps positive pulse
Port	0.6	30 ps positive pulse - port 0.7 goes high
I ² C-bus	address 30 H	IC104
I ² C-bus	address 70 H	display driver IC201
I ² C-bus	address A0 H	MTCXO oscillator
I ² C-bus	address 10 H	GPIOB interface
I ² C-bus	address 42 H	relay port DATA in the second cycle
I ² C-bus	address 40 H	LED port DATA in the second cycle
I ² C-bus	address 46 H	DAC level DATA in the second cycle
I ² C-bus	address 44 H	control port DATA in the second cycle
Port	0.1	30 ps positive pulse

The data sent to the four I/O circuits in the 16 sequence parts:

Data port:				The 44H port controls:			
42H	40H	46H	44 H	DAC	Pol.	Level	Sensitivity
00	00	00	00	A	+	0	variable
01	01	10	01	A	-	0	variable
03	03	20	02	A	+	level	variable
07	07	30	03	A	-	level	variable
0F	0F	40	04	A	+	0	max
1F	1F	50	05	A	-	0	max
3F	3F	60	06	A	+	level	max
7F	7F	70	07	A	-	level	max
FF	FF	00	80	B	+	0	variable
FE	FE	10	90	B	-	0	variable
FC	FC	20	A0	B	+	level	variable
F8	F8	30	80	B	-	level	variable
F0	F0	40	C0	B	+	0	max
E0	E0	50	D0	B	-	0	max
C0	C0	60	E0	B	+	level	max
80	80	70	F0	B	-	level	max
- and s>0 on -							
00	00	00	00	A	+	0	variable
01	01	10	01	A	-	0	variable

The 42H port controls the relay driver in the input amplifiers.

The 40H port controls the LED driver (key-top LEDs), which indicate correct function by blinking.

The 46H port controls the DAC circuit which supplies the voltage levels to the trigger- and sensitivity functions. While running the "Extended Test Program" the DAC circuit receives data, which converts to one ramp level on the output pin 3, and a second ramp level on the output pin 19. The ramp levels are shown in figure 73.

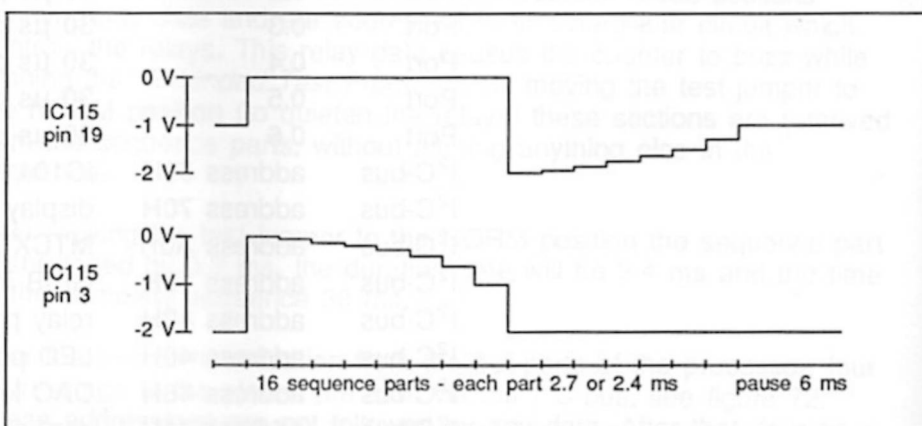


Figure 73. The test levels of the DAC circuit.

The 44H port controls those analog switches in the circuitry which direct the voltage levels of the DAC circuit to the correct receivers. The right-hand part of the table above displays the selected signal paths in consequence of varying data of the 44H port. The columns have the following meanings:

DAC refers to the DAC circuit IC115 and gives the letter (A or B) of the used output, see figure 73.

Pol. shows whether the output voltage from the DAC circuit is sent as a positive or as a negative level. If a negative level is to be sent, the positive voltage from the DAC is converted to a negative level by an op-amplifier.

Level tells whether the output voltage from the DAC circuit is sent ("level") or if ground is sent ("0").

Sensitivity tells whether the output voltage from the DAC circuit is sent ("variable") or if a fixed voltage, which represents the maximum of the sensitivity, is sent ("max").

The curves on "trigger level A", "trigger level B", "sensitivity A", and "sensitivity B" from the comparator IC111, while running the "Extended Test Program", are shown in figure 74.

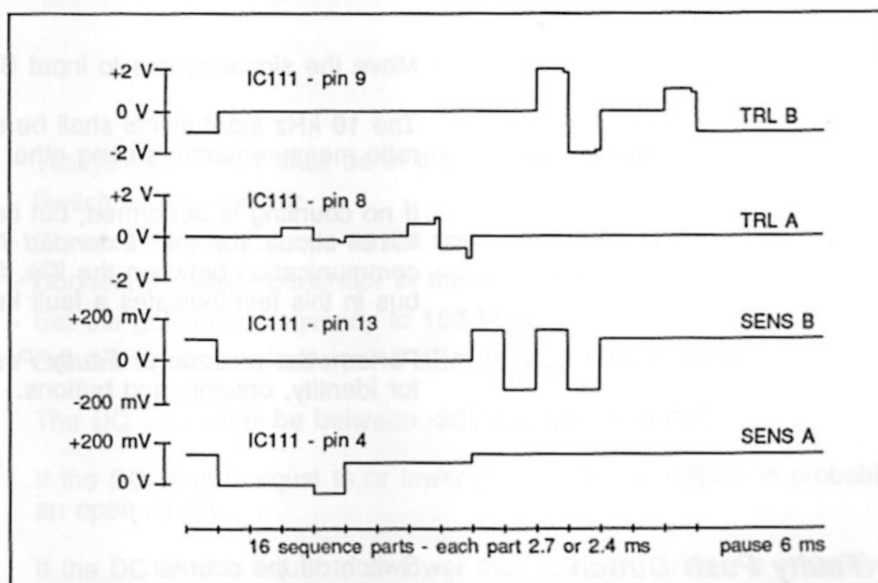


Figure 74. The test signals of the IC111 comparator.

Measuring setup for the oscilloscope:

- Set negative trig slope on port 2.0 (the best measuring port) or SDA.

To display part of the sequence:

- Set MTB to 0.2 ms/div. Use the variable control to stabilize the trace.
- Set DTB to 20 ps/div to monitor the I²C-bus.

To display the complete sequence:

- Set MTB to 5 ms/div. Use the variable control to stabilize the trace.
- Set DTB to 20 ps/div to monitor the I²C-bus.

Counting Fault

- Switch on the counter.
- Connect the LF synthesizer to input A and B.
- Set the frequency to 10 kHz sine wave.
- Set the signal amplitude to 0.5 V_p.
- Connect the oscilloscope probe to IC104 pin 3 (APRI).

The frequency of the input signal, divided by 10, shall be displayed as a CMOS square-wave signal.

If this signal is missed, try to manipulate the input controls. Deselect AUTO (PM 6666).

No signal at IC104 pin 3 indicates an input amplifier fault.

Miscounting in spite of correct signal at IC104 pin 3 indicates a fault in the IC104 circuit or an incorrect reference signal to the IC104.

- Move the probe to IC104 pin 2 (A).

The 10 kHz input signal shall be displayed. This signal is used for single period measurements, among other things.

- Move the signal source to input B and the probe to IC104 pin 1 (B).

The 10 kHz input signal shall be displayed. This signal is used for ratio measurements, among other things.

If no counting is performed, but correct signals are entered the IC104 circuit, run the *"Extended Test Program"* to check the internal communication between the ICs. Correct signal pattern on the I²C-bus in this test indicates a fault in the IC104 circuit.

Perform the procedure *"Faulty Push Button"* to verify correct codes for identity, options, and buttons.

• Faulty Push Button

- Switch off the counter.
- Move the test jumper on the basic board to the TEST position.
- Switch on the counter.
- Press the CALIB button on the basic board.

The counter shall display correct codes for pushed buttons. The tables for the codes are given on page 42 under *"Push Buttons"*.

If the counter displays a code without a button being pushed, either that button is conducting all the time, or the decoding circuitry is faulty.

A faulty decoding circuitry can be detected by reading the test pattern in the *"Extended Test Program"*, see page 62 (PM 6665), or page 64 (PM 6666).

• **HF Input**
(option)

Power up the instrument at least 10 minutes before measuring to let it attain normal working temperature.

Required measuring equipment, see page 7.

Counting Level

- Interconnect TP1 (BU302) and TP2 (BU304). The location of these can be seen in figure 75 on page 70.
- Perform the "*Sensitivity*" check described on page 49.
- Decrease the level from the "start counting" level until the instrument counts incorrectly. Increase the level again until the instrument counts correctly.

The lowest level for which the instrument counts correctly shall be equal to, or more than 3 dB below the start counting level, see the diagram on page 49. If not, perform the "*Input Protection and Amplifier*" check (page 70).

If the HF input passes the "*Input Protection and Amplifier*" check but fails the "*Counting Level*" check, the divider is faulty.

- Disconnect TP1 (BU302) from TP2 (BU304).

Input Protection; DC Levels

- Test jumper JP101 shall be in the NORM position.
- Switch on the counter.
- Connect the oscilloscope to the node GR304-C304-R312-L301.
- Connect the pulse generator to the HF input.
- Set the generator frequency to 100 MHz.
- Set the signal amplitude to 16 dBm (4 V_p) square wave.

The DC level shall be between -200 mV and -600 mV.

If the DC level is equal to or lower than -800 mV, GR311 is probably an open circuit.

If the DC level is equal to or lower than -50 mV, GR311 is probably short-circuited or GR303/GR304 faulty.

- Move the oscilloscope probe to the node GR303-GR304-C302-C303.

The DC level shall be between -100 mV and -300 mV.

If the DC level is higher than +600 mV then GR303 may be open circuit.

If the DC level is lower than -600 mV then GR304 may be open circuit.

If either of the diodes GR303 or GR304 is short-circuited, the DC level will be almost 0 volts.

Input Protection and Amplifier

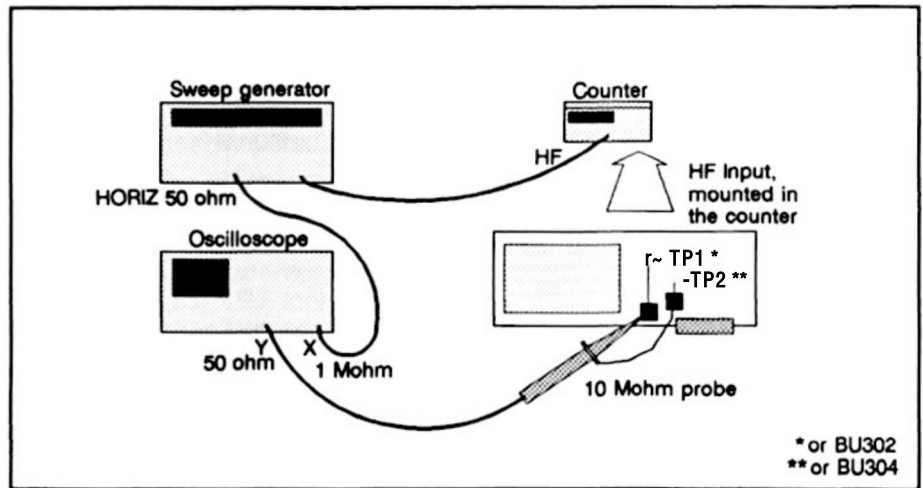


Figure 75. Measuring setup for sweep measurement.

- Connect the sweep generator to the HF input.
- Connect the horizontal output from the generator to the X channel of the oscilloscope.
- Connect the Y channel of the oscilloscope to BU302 and BU304 (ground) via the 10 Mohm probe.
- Set the sweep generator to the frequency range 70 - 1300 MHz.
- Set the signal amplitude to -15 dBm (40 mV_{p-p}).
- Typical frequency curves for the types PM 9608, PM 9608B, and PM 9615 are illustrated in figure 76.

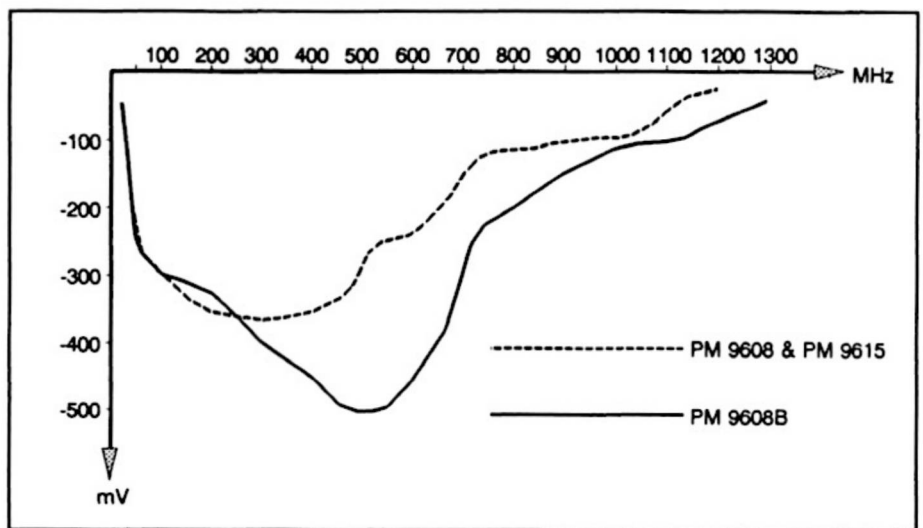


Figure 76. HF Input - frequency curve.