Frequency counters
PM 6667 and PM 6668

Instruction manual

9499 463 01617
860215 Second edition

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Industrial &
Electro-acoustic Systems

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Important

As the instrument is an electrical apparatus, it may be operated only by trained personnel. Maintenance and repairs may also be carried out only by qualified personnel.

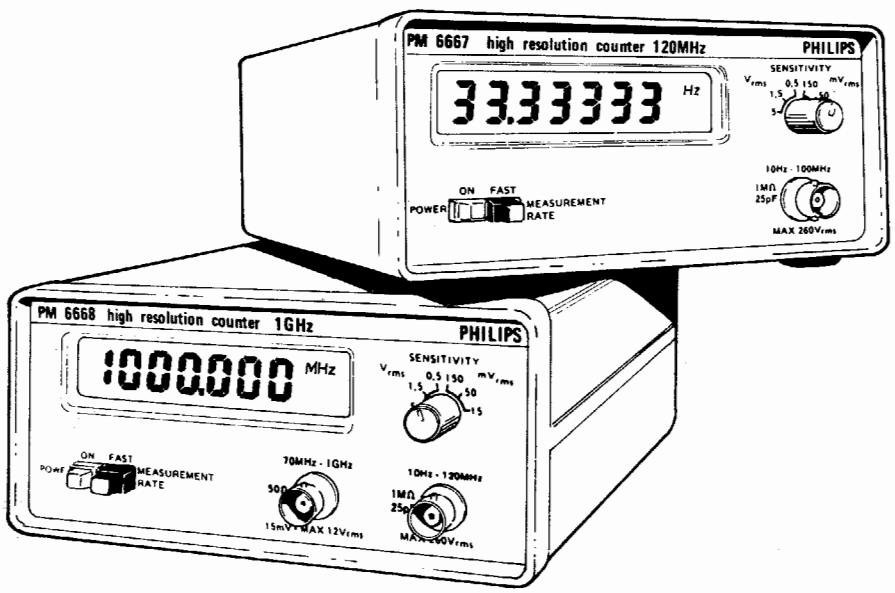
Please note

In correspondence concerning this instrument, please quote the type number and serial number as given on the type plate.

Printed in Sweden

Frequency counters
PM 6667 and PM 6668

Instruction manual



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1. Introduction

The PM 6667 and PM 6668 are microcomputer based frequency counters, spanning a frequency range of 10 Hz ... 120 MHz (PM 6667) and 10 Hz ... 1 GHz (PM 6668).

The use of the microcomputer allows a new approach in frequency measurements, that eliminates the traditional ±1 cycle error. By making a multiple period measurement and computing the reciprocal value, these counters perform high resolution frequency measurements on low frequency signals.

Another microcomputer feature in these counters is the automatic range selection. The measuring result is always displayed with maximum resolution without overflow and with proper indication of Hz, kHz, MHz and decimal point.

There is choice between two measurement rates; NORMAL with 7-digits resolution every second or FAST with 6 or 7-digits resolution every 200 ms. The fast mode is used for measuring changing frequencies as with tuning.

The following options are available: a more stable time base version with TCXO (/02 version), a rechargeable battery unit PM 9601 that can be mounted inside the counter, an impact resistant (ABS) protective carrying case PM 9602 and a 19" rack/panel mount adapter PM 9603.

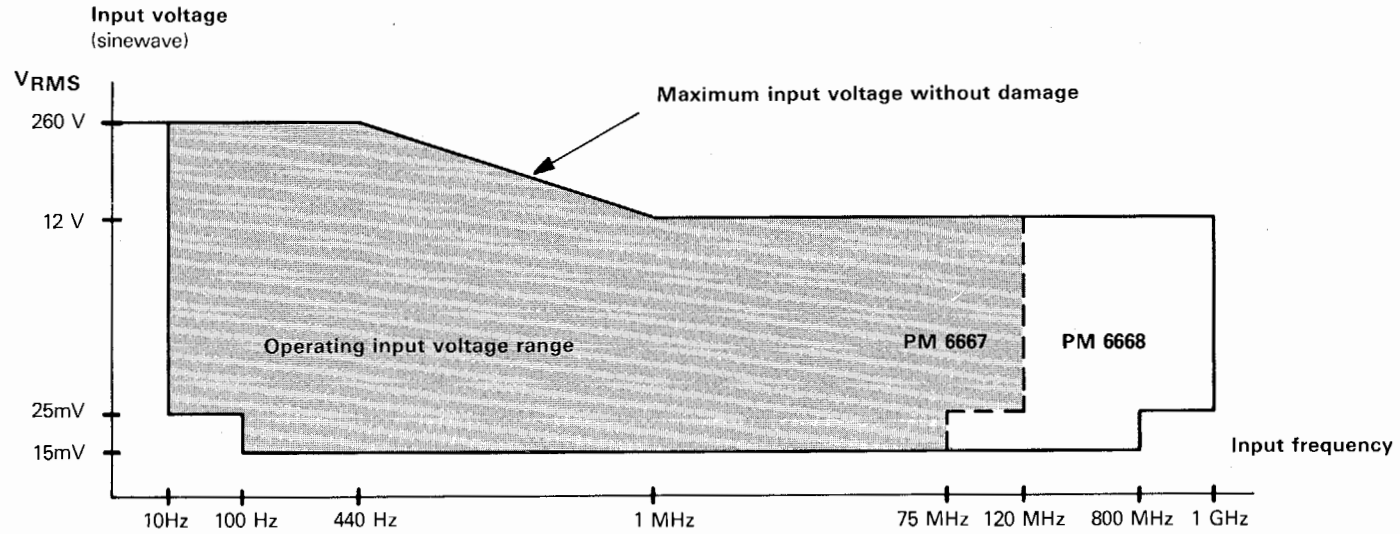
The 7-digit liquid crystal (LCD) display contains also the unit and decimal-point indicators.

After you switch on the counter, a self test is executed. Should an error be detected, it is shown on the display by a diagnostic code.

WARNING

Before connecting the instrument to the line voltage, read the safety regulations on page 5.

2. Technical specification



Frequency range

PM 6667: 10Hz .. . 120MHz
PM 6668: 10Hz ... 1GHz

Input sensitivity

(in $15mV_{RMS}$ position)

LF-input: $15mV_{RMS}$ sinewave; 100Hz ... 75MHz

$25mV_{RMS}$ sinewave; 10Hz ... 120MHz

$45mV_{p\text{-}p}$ for pulses with a pulse duration of ⩾ 7ns

RF-input: *(PM 6668 only)*

$15mV_{RMS}$ sinewave; 70MHz ... 800MHz

$25mV_{RMS}$ sinewave; 800MHz ... 1GHz

(see input voltage characteristics)

Input attenuation

LF-input: x 1 to x 300 in 6 positions
RF-input: automatic attenuation

Trigger level

A fixed (+, 0 or −) voltage is automatically applied to ensure proper triggering on any waveform and duty cycle.

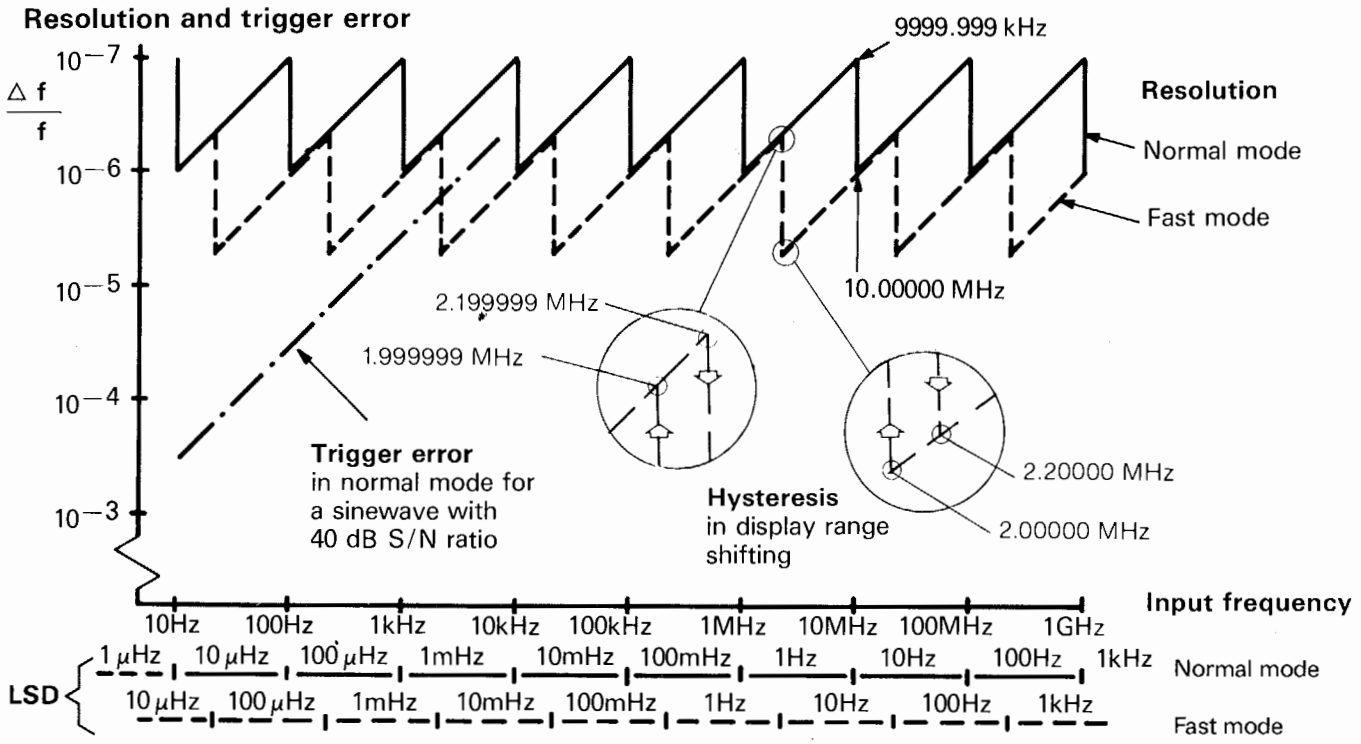
Coupling: AC

Input impedance

LF-input: 1MΩ// ≈ 25pF
RF-input: 50Ω nominal with VSWR < 2 (PM 6668 only)

Max. input voltage without damage

DC: 300V
AC: $260V_{RMS}$ at ⩽ 440Hz, falling to $12V_{RMS}$ at 1 MHz (see input voltage characteristics above)



Measurement rate

Normal, (out): approx 1 measurement/s
Fast, (in): approx 5 measurements/s; at frequencies below 100Hz, the measurement rate gradually slows down to one measurement per second to reduce the trigger error influence.

Display

7 digits, 11.5 mm, liquid crystal display with unit indication of Hz, kHz, MHz and LO BAT.

Inaccuracy (relative frequency error)

$$\pm \frac{\text{LSD}}{\text{input frequency}} \pm \text{rel. trigger error} \pm \text{time base error}$$

Rel. trigger error:

For any waveshape:

$$\frac{\text{Measurement rate}}{\text{Signal slope (V/s)}} \times \text{peak-to-peak noise voltage}$$

For sinewaves:

$$\frac{\text{Measurement rate}}{\text{Input frequency} \times \pi \times \text{S/N ratio}}$$

Example: for S/N ratio of 100 (40dB) and sample rate of 1 measurement/s, the trigger error is

$$\frac{3 \times 10^{-3}}{\text{input frequency}}$$

Resolution

For the least significant digit (LSD) and relative resolution see graph above

Ext. reference input

Frequency: 10MHz
Input voltage range: $0.5V_{RMS}$...$12V_{RMS}$
Input impedance: approx. 2kΩ

Power requirements

115/230V, ±15%, 50 ... 60Hz; 15VA or by built-in optional battery pack PM 9601 or by external 12V battery.

Time base characteristics

Time base version	/01 (standard)	/02 (TCXO)
X-tal frequency	10MHz	10MHz
Ageing	$\leqslant 5 \times 10^{-7}$/month	$\leqslant 1 \times 10^{-7}$/month
Temperature stability		
0 ... 50°C, ref. to +25°C	$\leqslant 1 \times 10^{-5}$	$\leqslant 1 \times 10^{-6}$
20 ... 30°C, ref. to +25°C	$\leqslant 3 \times 10^{-6}$ (typical)	$\leqslant 3 \times 10^{-7}$ (typical)

Safety

According to IEC 348 and CSA 556 B.

Line interference

Below class II CENELEC/CISPR

Dimensions and weight

Width: 160 mm (6,3 in)
Height: 77 mm (3 in)
Depth: 180 mm (7,1 in)
Weight: 1,2 kg (2,6 lb)

Environmental conditions

Temperature:

Storage:	−40°C ... +70°C
Operating:	0°C ... +45°C

Altitude/barometer pressure:

Storage: 15000 m (50000ft) /15.2kN/m²
Operating: 5000 m (15000 ft) /53.3kN/m²

Humidity:

10% ... 90% RH, (26°C dew point)

Vibration test: according IEC 68 Fc
Bump test: according IEC 68 Eb
Handling test: according IEC 68 Ec
Transport test: according NLN - L88

3. Accessories

3.1. Standard accessories
(Supplied with the instrument)

- Line power cord.
- Instruction manual.

3.2. Optional accessories
(To be ordered separately)

- PM 9601 Battery unit.
- PM 9602 Carrying case.
- PM 9603 19" rack/panel mount adapter.
- PM 9665 B 50kHz low pass filter, BNC–BNC.
- PM 9236 15 MHz, 10 M ohm attenuator probe set.
- PM 8935 250MHz, 10 M ohm attenuator probe set.
- Battery jack (see section 5 and 7.5 in this manual).

4. Battery unit PM 9601

4.1. General information

The PM 9601 is a rechargeable battery unit for inside mounting in the counters PM 6667 and PM 6668.

The unit contains a standard 6V, sealed battery of solid gel lead acid type. It further contains the charging and overcharge protection circuitry.

The battery unit is fixed with four screws in the metal innerframe of the cabinet (see the installation instructions).

The battery is of a standard type and is available from variety of battery manufacturers. To obtain spare batteries, contact directly your battery supplier who stores fresh and fully charged batteries:

Manufacturer	Country of origin	Type	Capacity
Sonnenschein*	W-Germany	3GX3S	3 Ah
Varta*	W-Germany	Accu Pb30704063	3 Ah
Gold Gelyte	USA	Pb 626-1	2.6 Ah
Elpower	USA	Ep 626A-6	2.6 Ah
SAFT*	France	PA 601	4 Ah
Kono	Japan	6-26k	2.6 Ah

* recommended brand

WARNING

The capacity of rechargeable batteries degrades when the batteries are not used or recharged frequently. Read therefore carefully the instructions for storage!

4.2. Recharging

The battery is automatically recharged when the counter is connected to the line voltage and the power switch is in OFF position.

When "LO BAT" is indicated on the display, about 15 minutes of operation remain before recharging is needed.

The counter automatically switches over to internal battery supply if line voltage fails.

To prevent unwanted discharging of the batteries when the counter is not used, always use the power switch to turn off the counter, not the line power cord.

Recharging time (typical at 20°C) 10h to 90% of full capacity, 5h to 70% of full capacity.

4.3. Storing

Avoid storage of completely discharged batteries.

When the instrument is not in use, set power switch in OFF position but keep the instrument connected to the line voltage. The battery will then be kept fully charged and always ready for use. If the instrument can not be connected to the line voltage or when the battery pack is stored outside the instrument, recharging during 5 to 10h every 3 months is recommended.

If longer storage periods are needed, remove the fuse in the battery unit and store the battery cool and dry.

WARNING

Permanent use and storage at high temperatures adversely affects the life of the battery.

Prolonged storage and operation above +40°C and charging above +35°C should be avoided.

For storage at −40°C, the battery must be charged to at least 75% of its full capacity.

Other environmental conditions are the same as for the main instrument.

Additional weight for battery pack: 0.75 kg.

Fuse: 1.6A fast action.

5. External battery

An external 12V battery can be used to power the counter. Replace rear BNC connector by a battery jack as described in section 7.5. of this manual.

NOTE

The battery jack including the plug can be obtained free of charge from:

Philips Elektronikindustrier AB
Div. I
Supply Center
S-175 88 JÄRFÄLLA
Sweden

Please indicate the type number and the serial number of your instrument.

6. Safety regulations

(in accordance with IEC 348)

Before connecting the instrument to the line voltage, visually check the cabinet, controls and connectors etc. to ascertain that no damage has occured in transit.

If any defects are apparent, do not connect instrument to the mains (line). The instrument must be disconnected from all voltage sources, and any high voltage points discharged before any maintenance or repair work is carried out.

If adjustments or maintenance of the operating instrument with covers removed is inevitable, it must be carried out only by a skilled person who is aware of the hazard involved.

NOTE

All parts on the primary side of the transformer are CSA approved and should be replaced only by original parts.

7. Installation

7.1. Line connection

Before connecting the instrument to the line, make sure it is set to the local line voltage. On delivery, the instrument is set to 115V or 230V ±15%, which is indicated on the rear of the instrument. If the instrument has to be set to another voltage than indicated, contact your local service organization.
The service manual contains setting instructions.

7.2. Grounding

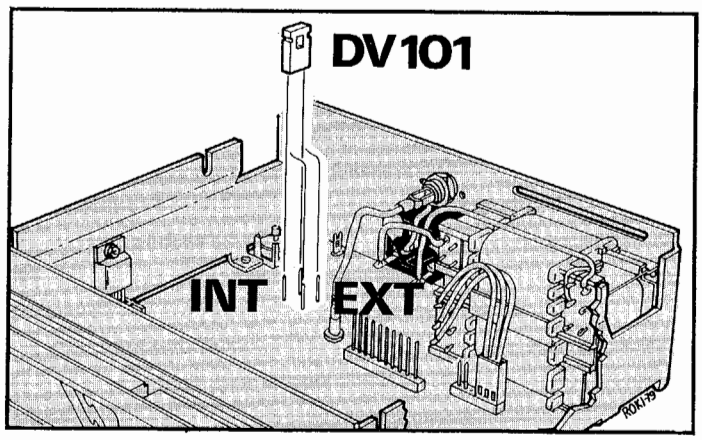
The instrument is grounded via the three-core line power cord plugged into an outlet with protective ground contact.

No other way of safety grounding is allowed.

7.3. Internal and external standard

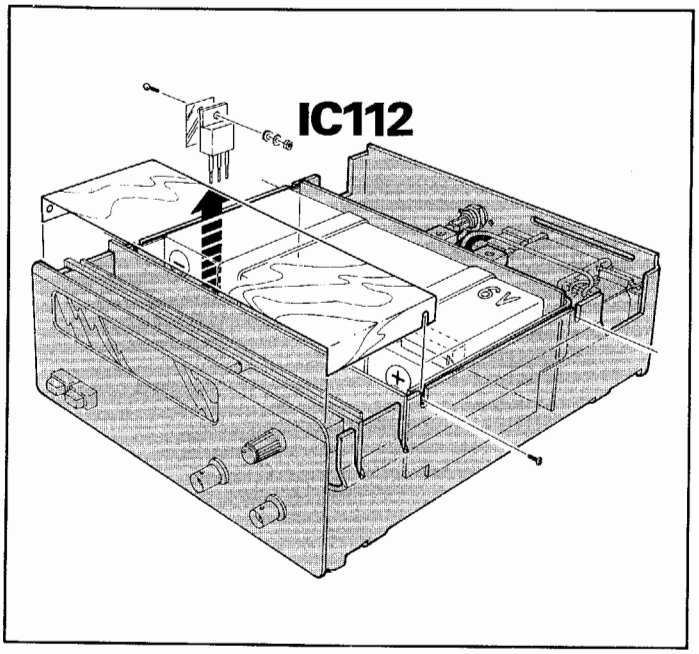
The counter can be set to external or internal standard by setting the jumper connector DV 101 as shown in the figure below.

At delivery the counter is set to internal standard.



7.4. Internal battery unit PM 9601

- Remove housing of counter.
- Remove the upper screening plate.
- Remove +5V regulator IC 112 (see figure below).
- Place battery unit as shown in figure below. Keep wires from battery to p.c. board along the edges of the battery.
- Mount the new screening plate as shown in figure below and secure it to the sidewalls of the counter with 2 screws.
- Secure unit with screws to sidewalls of counter.



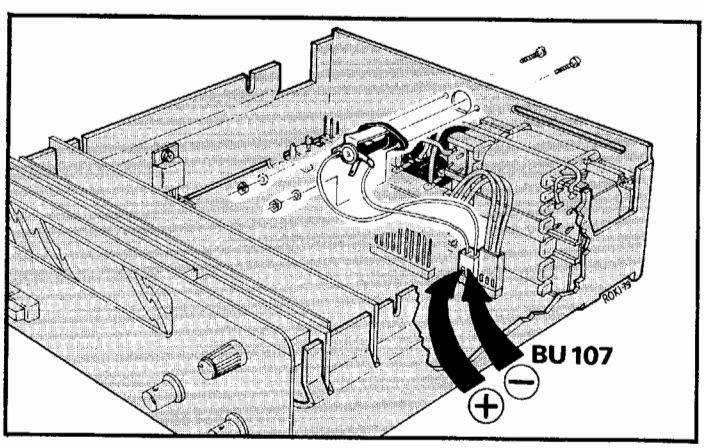
7.5. External Battery Jack

The rear BNC connector for External Standard can be replaced by a battery jack for External Battery supply. The jack fits to DIN 45323.

Proceed as follows to change from BNC connector to battery jack:

- Loosen coaxial cable from p.c. board and unsolder central lead from BNC connector.
- Replace BNC connector with battery jack and connect the two-pole connector so it fits the polarity of your battery plug. See figure below.

The two pins connector (p/o BU 107) is diode-protected to prevent damage if the input polarity is shifted.



8. Controls & connectors

POWER ON

Turns counter on/off. CAUTION: This is a secondary power switch. Even in the POWER OFF position, the counter contains live conductors and parts. The line cord has to be removed to fully unpower the counter.

In case of line power failure the counter automatically switches over to battery supply.

MEASUREMENT RATE

Sets measurement rate to one of two speeds. NORMAL (released) or FAST (depressed).

NORMAL rate means about 1 measurement/s and FAST rate about 5 measurements/s. The measurement rate in the FAST position will be reduced at lower frequencies down to about 1 measurement/s at 10Hz.

SENSITIVITY

Sets input sensitivity in 6 steps from 15mV$_{RMS}$ to 5 V$_{RMS}$.

NOTE: to reduce the influence from noise and interference, never set to higher sensitivity than necessary.

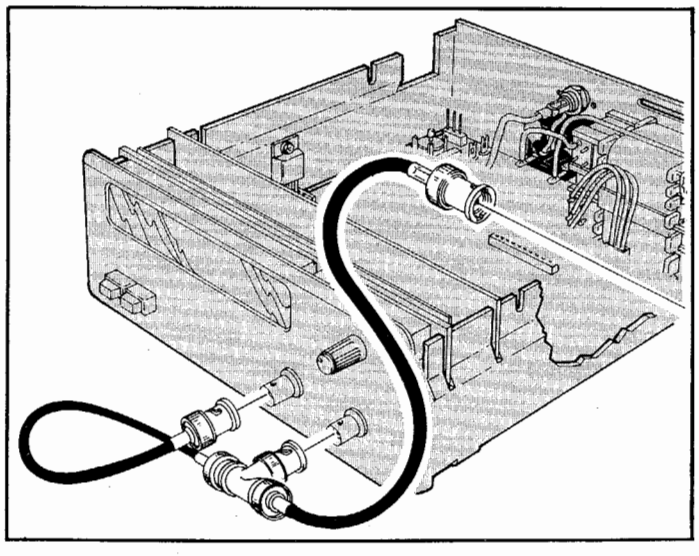
LF input

A high-ohmic (1Mohm), AC-coupled input for signals with frequencies from 10Hz to 120MHz. An **auto-trigger** circuit ensures correct triggering on both sinewaves and pulses with any duty factor.

RF input (PM 6668 only)

A low-ohmic (50 ohm), AC-coupled input for sinewave signals with frequencies from 70MHz to 1GHz.

The microcomputer of the counter detects the presence of an RF signal and selects this input automatically when the input frequency is high enough for counting. This makes it possible to connect the same signal to both inputs via a T-piece. See figure below.



The counter will then switch automatically between the two inputs when the signal frequency is changing, e.g. when measuring a frequency sweep.

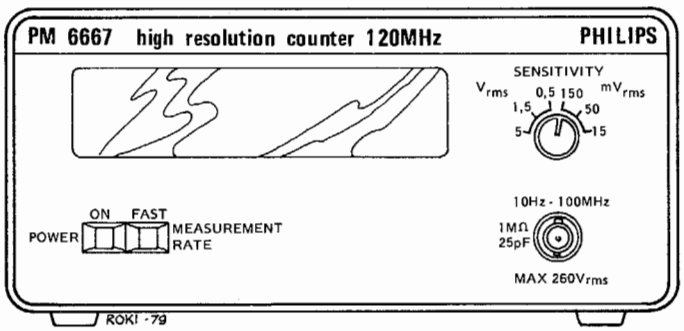
More information on the input signal is given in the Technical Specifications.

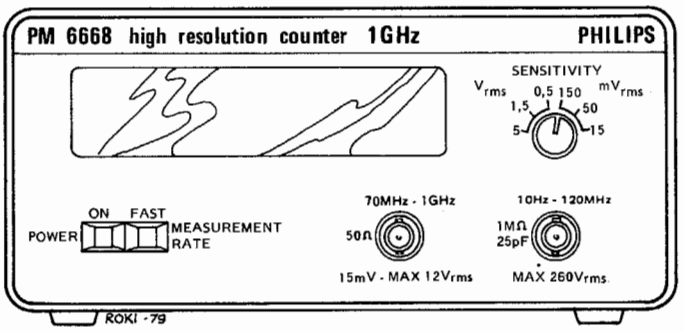
EXTERNAL STANDARD or BATTERY

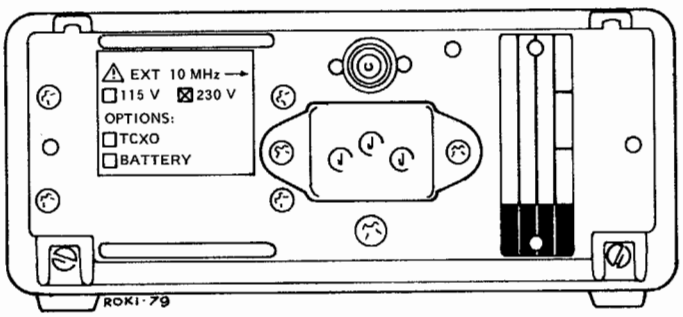
BNC input for external time base standard or, as optional extra, battery jack for external battery.

Line voltage receptacle

Input for line voltage. Always use the three-core line power cord supplied with the counter.







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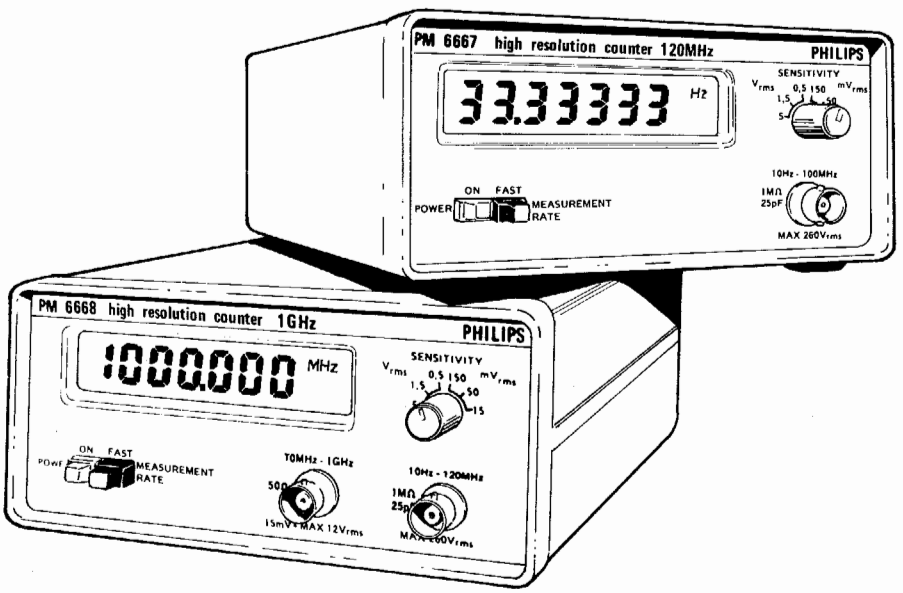
Gebrauchsanleitung



1. Einleitung

PM 6667 und PM 6668 sind mikrocomputergesteuerte Frequenzzähler für den Messbereich von 10 Hz ... 120 MHz (PM 6667) und 10 Hz ... 1 GHz (PM 6668).

Dank des Mikrocomputers eröffnen sich neue Möglichkeiten der Frequenzmessung. Der bisher übliche ±1 Digit Fehler wird eliminiert. Durch Vielfachperiodenmessung und Berechnung des reziproken Werts ermöglichen diese Zähler die Messung von niedrigfrequenten Signalen mit hoher Auflösung.

Ein weiterer Vorteil des Mikrocomputers ist die automatische Bereichswahl. Die Messergebnisse werden immer mit maximaler Auflösung ohne Überlauf und mit korrekter Angabe der Dimension (Hz, kHz, MHz) und des Dezimalpunkts angezeigt.

Es kann zwischen zwei Messgeschwindigkeiten gewählt werden: NORMAL mit 7-stelliger Auflösung jede Sekunde oder FAST mit 6- oder 7-stelliger Auflösung alle 200 ms. Die schnelle Betriebsart FAST wird zur Messung wechselnder Frequenzen etwa beim Abgleichen verwendet.

Folgendes Zubehör ist zusätzlich lieferbar: Eine stabilere Zeitbasis mit TCXO* (Bauart/02), eine Batterie-Ladeeinheit PM 9601 zum Einbau im Zähler, eine schlagfeste Tragtasche PM 9602 und ein 19''-Einbau-Adapter PM 9603.

Die 7-stellige LCD-Anzeige gibt Dimension und Dezimalpunkt, sowie den Ladezustand der eingebauten Batterien an.

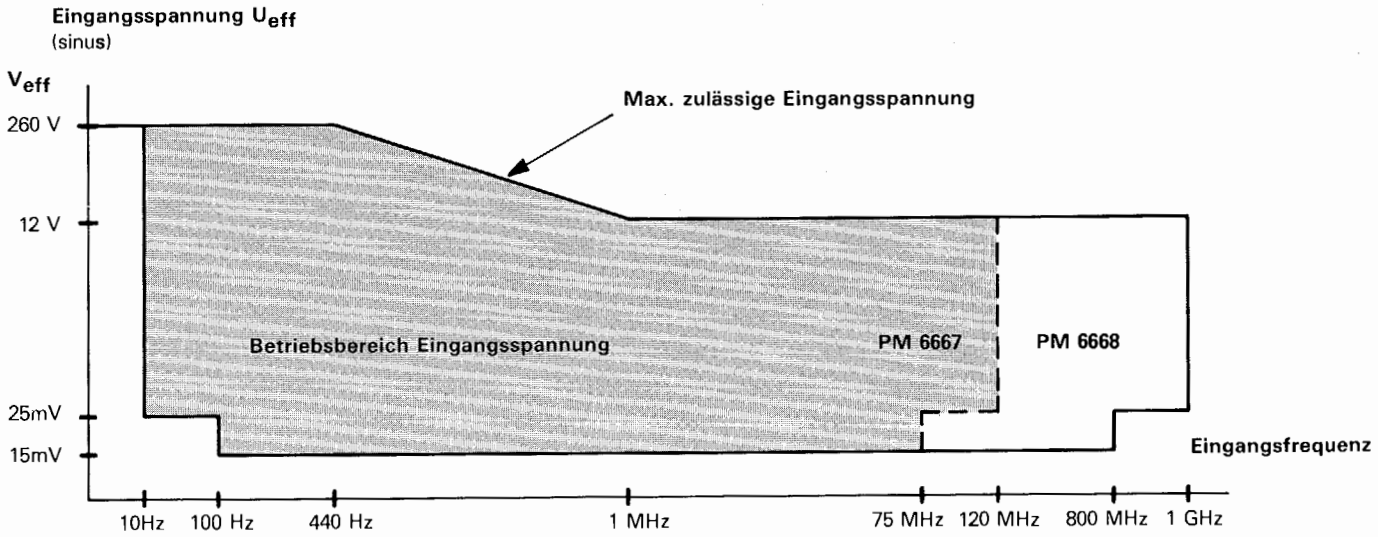
Nach dem Einschalten nimmt der Zähler eine Eigenkontrolle vor. Werden dabei Fehler festgestellt, leuchtet auf dem Anzeigefeld ein diagnostischer Code auf.

WARNUNG

Lesen Sie die Sicherheitsvorschriften auf Seite 11, bevor Sie das Gerät ans Netz anschliessen!

* TCXO = Temperaturkompensierter Kristalloszillator

2. Technische Daten



Frequenzbereich

PM 6667: 10Hz .. . 120MHz
PM 6668: 10Hz ... 1GHz

Eingangsempfindlichkeit

(in Stellung 15mV_{eff})

NF-Eingang: 15mV_{eff} sinus; 100Hz ... 75MHz

25mV_{eff} sinus; 10Hz ... 120MHz

45mV_{ss} für Impulse mit einer Dauer von ⩾ 7ns

HF-Eingang:(nur PM 6668)
15mV_{eff} sinus; 70MHz ... 800MHz

25mV_{eff} sinus; 800MHz ... 1GHz

(siehe Eingangsspannungs-Charakteristik)

Eingangsabschwächung

NF-Eingang: 6 Schaltstellungen von x 1 bis x 300
HF-Eingang: Automatische Abschwächung

Triggerpegel

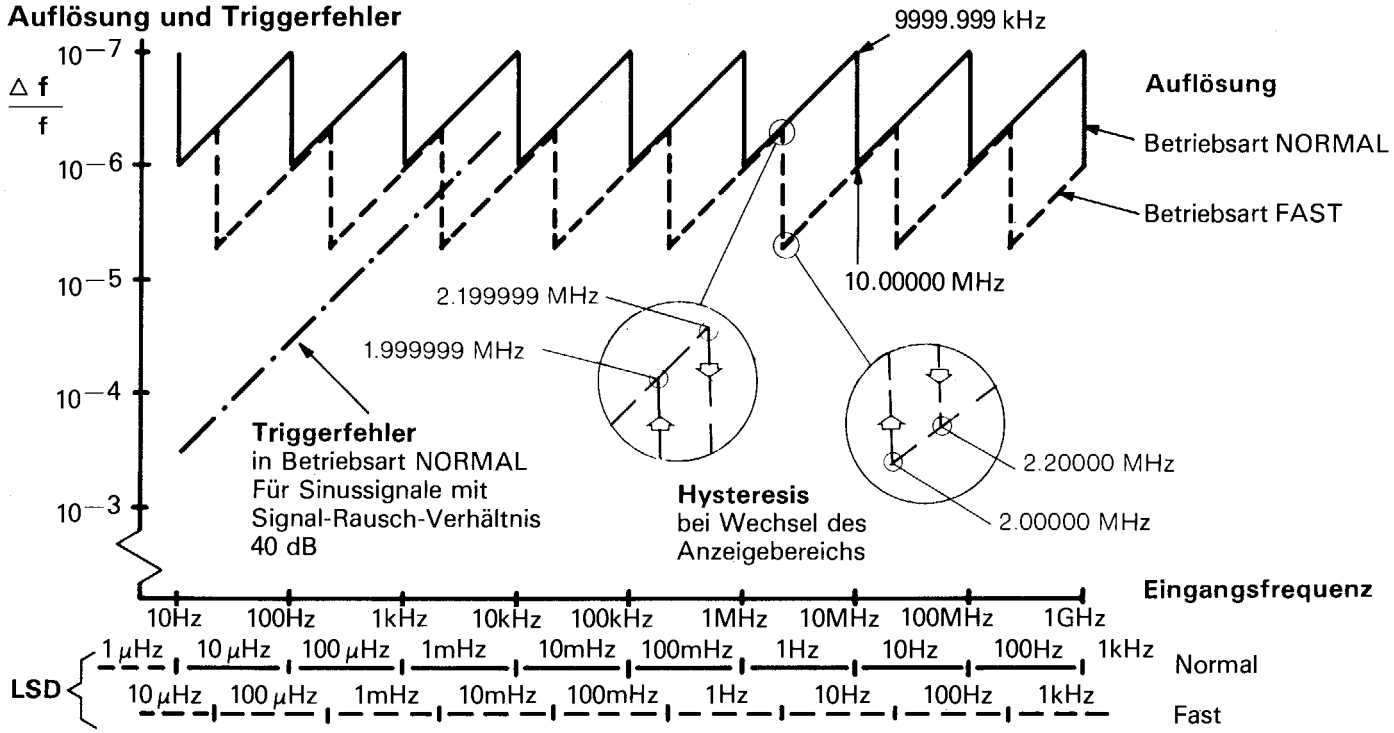
Eine feste Spannung (+, 0 oder −) sorgt automatisch für korrekte Triggerung bei jeder Signalform und jedem Tastverhältnis.

Kopplung: AC

Eingangsimpedanz

NF-Eingang: 1MΩ// ≈ 25pF
HF-Eingang: 50Ω Nennwert bei Stehwellenverhältnis VSWR < 2 (nur PM 6668)

Auflösung und Triggerfehler



Maximal zulässige Eingangsspannung

DC: 300V
AC: U_{eff} = 260V (bei ⩽ 440Hz), fallend auf 12V (bei 1 MHz) (siehe Eingangsspannungs-Charakteristik)

Messgeschwindigkeit

Normal: ca. 1 Messung/s
Fast: ca. 5 Messungen/s. Bei Frequenzen von unter 100Hz verringert sich die Messgeschwindigkeit allmählich bis auf eine Messung je Sekunde, um den Einfluss des Triggerfehlers auszugleichen.

Anzeige

7 digits (Ziffernhöhe 11,5 mm), Flüssigkristalle mit Anzeige von Dimension (Hz, kHz, MHz) und Batterieladezustand (LO BAT).

Fehlergrenze (relativer Frequenzfehler)

$$\pm \frac{\text{LSD*}}{\text{Eingangsfrequenz}} \pm \text{Rel. Triggerfehler**} \pm \text{Zeitbasisfehler}$$

* Digit niedrigster Wertigkeit = LSD = Least Significant Digit

** *Rel. Triggerfehler:*

Für beliebige Signalformen:

$$\frac{\text{Messgeschwindigkeit}}{\text{Signalflanke (V/s)}} \times \text{Spitzenwert der Rauschspannung}$$

Für Sinussignale:

$$\frac{\text{Messgeschwindigkeit}}{\text{Eingangsfrequenz} \times \pi \times \text{S/N ***}}$$

*** Signal/Rauschverhältnis

Beispiel: Bei einem Signal-Rausch-Verhältnis (S/N) von 100 (40dB) und einer Messgeschwindigkeit von 1 Messung/s beträgt der Triggerfehler:

$$\frac{3 \times 10^{-3}}{\text{Eingangsfrequenz}}$$

Auflösung

Digit niedrigster Wertigkeit (LSD) und relative Auflösung (siehe Diagramm).

Externer Referenzeingang

Frequenz: 10 MHz
Eingangsspannung U_{eff}: 0,5V...12V

Eingangsimpedanz: ca. 2kΩ

Speisung

115/230V, ±15%, 50...60Hz; 15VA oder durch wahlweise eingebaute Batterieeinheit PM 9601 oder durch externe 12V-Batterie.

Sicherheitsvorschriften

Nach IEC 348 und CSA 556 B.

Netzstörungen

Niedriger als Klasse II CENELEC/CISPR

Abmessungen und Gewicht

Breite: 160 mm
Höhe: 77 mm
Tiefe: 180 mm
Gewicht: 1,2 kg

Umgebungsbedingungen

Temperatur

Lagerung: −40°C ... +70°C
Betrieb: 0°C ... +45°C

Höhe/Luftdruck

Lagerung: 15000 m/15,2 kN/m²
Betrieb: 5000 m/53,3 kN/m²

Feuchtigkeit

10% ... 90% rel. Luftfeuchtigkeit (Taupunkt 26°C)

Vibration: entspr. IEC 68 Fc
Stossfestigkeit: entspr. IEC 68 Eb
Hantierung: entspr. IEC 68 Ec
Transport: entspr. NLN - L88

Zeitbasischarakteristik

Zeitbasis	/01 (Standard)	/02 (TCXO)*
Kristallfrequenz	10MHz	10MHz
Alterung	⩽ 5 x 10^{-7}/Monat	⩽ 1 x 10^{-7}/Monat
Temperaturstabilität		
0...50°C, bez. auf +25°C	⩽ 1 x 10^{-5}	⩽ 1 x 10^{-6}
20...30°C, bez. auf +25°C	⩽ 3 x 10^{-6} (typisch)	⩽ 3 x 10^{-7} (typisch)

* TCXO = Temperaturkompensierter Kristalloszillator

3. Zubehör

3.1. Mitgeliefertes Standardzubehör

- Netzkabel
- Betriebsanleitung

3.2. Wahlweises Zubehör
(gesondert zu bestellen)

- PM 9601 Batterie-/Ladeeinhet
- PM 9602 Tragtasche
- PM 9603 19''-Einbau-Adapter
- PM 9665 B 50-kHz-Tiefpassfilter, BNC—BNC
- PM 9236 1:10 Tastkopf 15 MHz, 10 MOhm
- PM 8935 1:10 Tastkopf 250 MHz, 10 MOhm
- Batteriebuchse (siehe Abschnitt 5 und 7.5 dieser Betriebsanleitung)

4. Batterieeinhet PM 9601

4.1. Allgemeines

Die PM 9601 ist eine wiederaufladbare Batterie-/Ladeeinheit zum Einbau in die Zähler PM 6667 und PM 6668.

Die Einheit enthält gasdichte 6V Bleiakkumulatoren sowie Steuerkreise für Ladung und Überladungsschutz.

Die Batterie-/Ladeeinheit wird mit vier Schrauben am metallenen Innenrahmen des Gehäuses befestigt (siehe Montageanleitung).

Es können Standardakkus verschiedener Hersteller verwendet werden. Ersatzakkus erhalten Sie im Fachhandel:

Hersteller	Ursprungs-land	Typ	Kapa-zität
Sonnenschein*	West-deutschland	3GX3S	3 Ah
Varta*	West-deutschland	Accu Pb30704063	3 Ah
Gold Gelyte	USA	Pb 626-1	2,6 Ah
Elpower	USA	Ep 626A-6	2,6 Ah
SAFT*	Frankreich	PA 601	4 Ah
Kono	Japan	6-26k	2,6 Ah

* Empfohlene Marke

WARNUNG

Wiederaufladbare Batterien verlieren an Kapizität, wenn sie nicht benutzt oder nur selten wiederaufgeladen werden. Beachten Sie daher genau die Lagerungsvorschriften!

4.2. Wiederaufladung

Die Batterie wird automatisch wiederaufgeladen, wenn der Zähler ans Netz angeschlossen ist und der Netzschalter auf OFF steht.

Erscheint auf der Anzeige "LO BAT", bleiben noch 15 Minuten Betriebszeit, bevor die Batterie wiederaufgeladen werden muss.

Bei Ausfall der Netzspannung schaltet der Zähler automatisch auf die interne Batterie um.

Zum Abschalten des Geräts immer den Netzschalter benutzen, nicht das Netzkabel! Dadurch vermeidet man eine unerwünschte Entladung der Batterie ausser Betrieb.

Wiederaufladedauer (typischer Wert bei 20°C) 10h auf 90% der vollen Kapazität, 5h auf 70% der vollen Kapazität.

4.3. Lagerung

Vermeiden Sie es, völlig entladene Batterien zu lagern.

Wenn das Gerät ausser Betrieb ist, Netzschalter auf OFF stellen, das Netzkabel jedoch stecken lassen. Die Batterie bleibt dann immer voll aufgeladen und betriebsbereit. Falls das Gerät nicht ans Netz angeschlossen werden kann oder die Batterie ausserhalb des Geräts gelagert wird, empfehlen wir eine 5—10stündige Aufladung alle 3 Monate.

Bei längerer Lagerung die Sicherung aus der Batterieeinheit herausnehmen und die Batterie kühl und trocken lagern.

WARNUNG

Ständige Verwendung und Lagerung bei hohen Temperaturen beeinträchtigt die Lebensdauer der Batterie.

Längerdauernder Betrieb und Lagerung bei über +40°C sowie Ladung bei über +35°C sollten vermieden werden.

Zur Lagerung bei —40°C ist die Batterie auf mindestens 75% der vollen Kapazität aufzuladen.

Im übrigen gelten dieselben Umgebungsbedingungen wie für den Zähler selbst.

Gewicht der Batterieeinheit: 0,75 kg.

Sicherung: 1,6 A flink.

5. Externe Batterie

Für den Betrieb des Zählers kann eine externe 12V-Batterie verwendet werden. Dazu ist der rückwärtige BNC-Anschluss wie in Abschnitt 7.5 beschrieben durch eine Batteriebuchse zu ersetzen.

ZUR BEACHTUNG

Batteriebuchse und zugehöriger Stecker sind kostenlos erhältlich von:

Philips GmbH
z. Hd. Herrn Köbisch
Abtlg. VGE
Postfach 310 320
3500 Kassel

Bitte geben Sie Typennummer und Seriennummer Ihres Geräts an.

6. Sicherheits-vorschriften

(nach IEC 348)

Vor dem Anschluss des Geräts an das Netz sind Gehäuse, Bedienungsorgane, Buchsen usw. auf etwaige Transportschäden zu überprüfen.

Werden Schäden bemerkt, darf der Zähler nicht ans Netz angeschlossen werden. Das Gerät muss von sämtlichen Spannungsquellen getrennt werden und alle etwaigen Hochspannungskapazitäten sind zu entladen, bevor Wartungs- bzw. Reparaturarbeiten vorgenommen werden.

Abgleich- oder Wartungsarbeiten, bei denen das Gerät angeschlossen und geöffnet sein muss, dürfen nur von Fachpersonal ausgeführt werden, das sich der bestehenden Gefahr bewusst ist.

ZUR BEACHTUNG

Sämtliche Teile auf der Primärseite des Transformators sind CSA-geprüft und sollten nur durch Originalteile ersetzt werden.

7. Inbetriebnahme

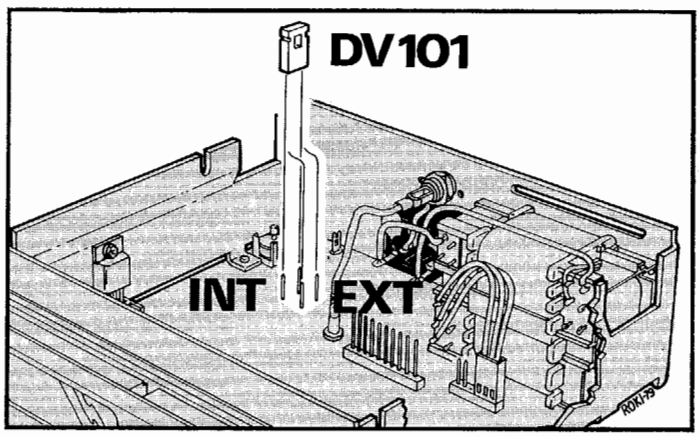
7.1. Netzanschluss

Überprüfen Sie vor Anschluss des Geräts, dass es auf die örtliche Netzspannung eingestellt ist. Bei Lieferung ist der Zähler auf 115V oder 230V ±15% eingestellt — abzulesen auf der Geräterückseite. Muss eine andere Spannung eingestellt werden, wenden Sie sich bitte an Ihre Servicedienststelle. Das Service-Handbuch enthält die notwendigen Anleitungen.

7.2. Interner und externer Standard

Durch Umstecken der Verbindung DV101 lässt sich der Zähler auf (siehe Abbildung unten) externen oder internen Standard einstellen.

Bei Lieferung ist der Zähler auf internen Standard eingestellt.



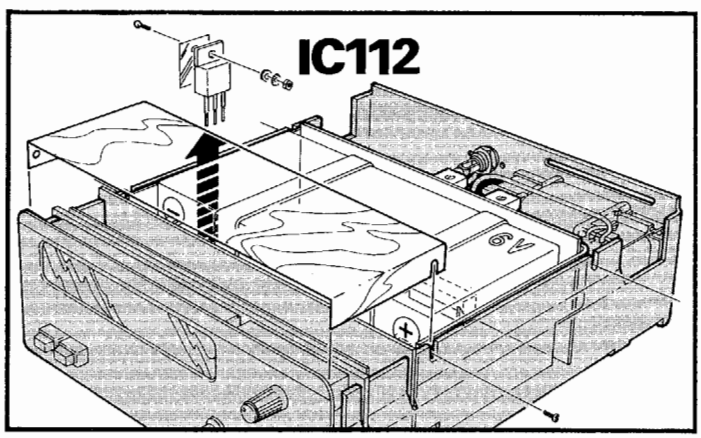
7.3. Erdung

Das Gerät ist über das 3adrige Netzkabel geerdet, das an eine Schutzkontakt-Steckdose anzuschliessen ist.

Keine andere Form der Sicherheitserdung ist erlaubt.

7.4 Einbau der Batterie-/Ladeeinheit PM 9601

- Zählerdeckel abnehmen.
- Obere Schutzplatte abnehmen.
- +5V-Regler IC 112 ausbauen (siehe Abbildung unten).
- Batterieeinheit wie auf der Abbildung unten gezeigt einsetzen. Drähte von der Batterie zur Leiterplatte an den Batteriekanten entlang führen.
- Neue Abdeckung wie auf der Abbildung gezeigt aufstecken und mit zwei Schrauben seitlich am Chassis befestigen.
- Einheit seitlich am Chassis festschrauben.



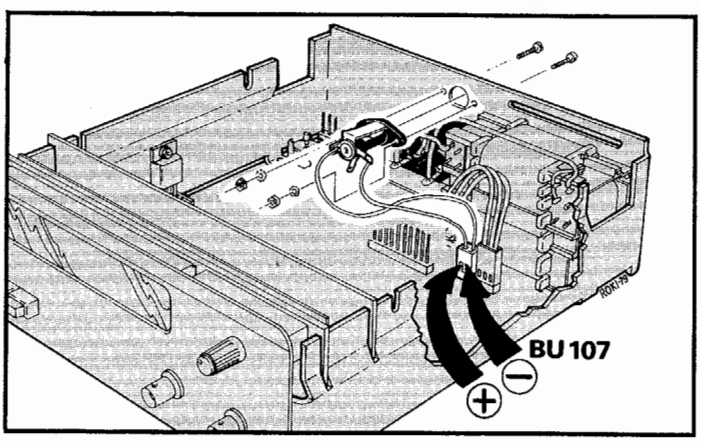
7.5. Buchse für externe Batterie

Der rückwärtige BNC-Anschluss für externen Standard kann durch eine Buchse für externe Batterieversorgung ersetzt werden. Die Buchse passt für DIN 45323.

Um den BNC-Anschluss gegen die Batteriebuchse auszutauschen, geht man wie folgt vor:

- Koaxialkabel von der Leiterplatte losmachen und den Mittelleiter vom BNC-Anschluss ablöten.
- BNC-Anschluss gegen Batteriebuchse austauschen und den zweipoligen Verbindungsstift so anschliessen, wie es der Polarität Ihres Batteriesteckers entspricht. Vgl. Abbildung unten.

Der zweipolige Verbindungsstift (p/o BU 107) ist diodengeschützt, um Beschädigungen durch falsche Polarität zu verhindern.



8. Bedienungsorgane und Anschlüsse

POWER ON

Ein-/Ausschaltung des Zählers. ACHTUNG: Es ist dies kein vollständiger Netzschalter. Auch in Stellung POWER OFF hat der Zähler spannungsführende Teile und Leiter. Um das Gerät völlig vom Netz zu trennen, muss das Netzkabel gezogen werden.

Bei Netzausfall schaltet der Zähler automatisch auf Batteriespeisung um.

MEASUREMENT RATE

Einstellung auf eine von zwei Messgeschwindigkeiten: NORMAL (Taste gelöst) oder FAST (Taste gedrückt).

NORMAL bedeutet etwa 1 Messung/s und FAST etwa 5 Messungen/s. Die Messgeschwindigkeit in Stellung FAST verringert sich bei niedrigen Frequenzen bis auf etwa 1 Messung/s bei 10 Hz.

SENSITIVITY

Einstellung der Empfindlichkeit in 6 Stufen von 15mV$_{eff}$ bis 5 V$_{eff}$.

ZUR BEACHTUNG: Nie auf höhere Empfindlichkeit als notwendig einstellen, um Rausch- und Störeinflüsse so gering wie möglich zu halten.

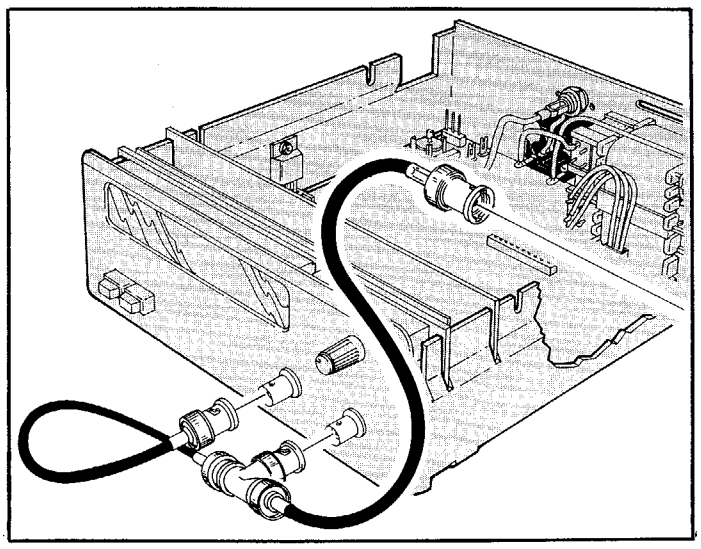
NF-Eingang

Hochohmiger (1 MOhm), AC-gekoppelter Eingang für Signale mit einer Frequenz von 10 Hz bis 120 MHz. Ein **Auto-Triggerkreis** gewährleistet korrekte Triggerung bei Sinussignalen und Impulsen mit beliebigem Tastverhältnis.

HF-Eingang (PM 6668)

Niedrigohmiger (50 Ohm), AC-gekoppelter Eingang für Sinussignale mit einer Frequenz von 70 MHz bis 1 GHz.

Der Mikrocomputer des Zählers registriert das Vorhandensein von HF-Signalen und wählt automatisch diesen Eingang, wenn die Frequenz genügend hoch ist. Dadurch ist es möglich, dasselbe Signal über ein T-Stück an beide Eingänge zu legen. Siehe Abbildung unten.



Bei wechselnder Frequenz, wie z.B. der Messung von Frequenzhüben, schaltet der Zähler dann selbsttätig zwischen den beiden Eingängen um.

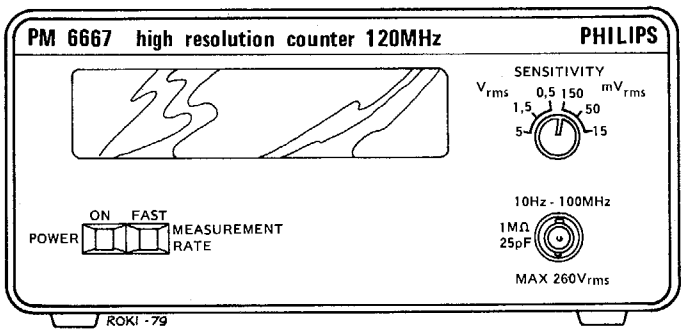
Weitere Einzelheiten über das Eingangssignal finden Sie im Abschnitt "Technische Daten".

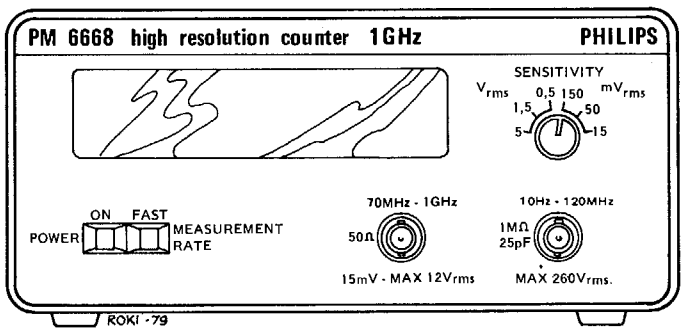
EXTERNER STANDARD oder BATTERIE

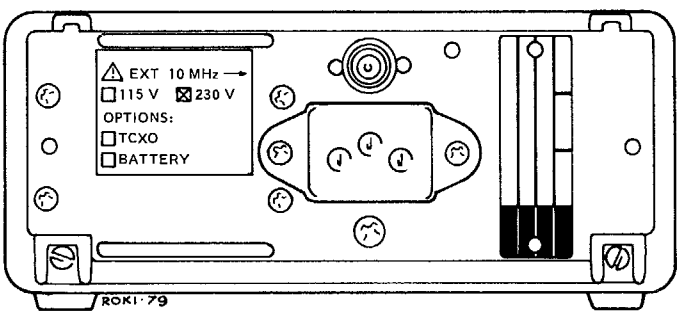
BNC-Anschluss für externe Zeitbasis oder — als wahlweiser Zusatz — Buchse für externe Batterie.

Netzeingang

Anschluss der Netzspannung. Immer das mitgelieferte 3adrige Netzkabel verwenden.

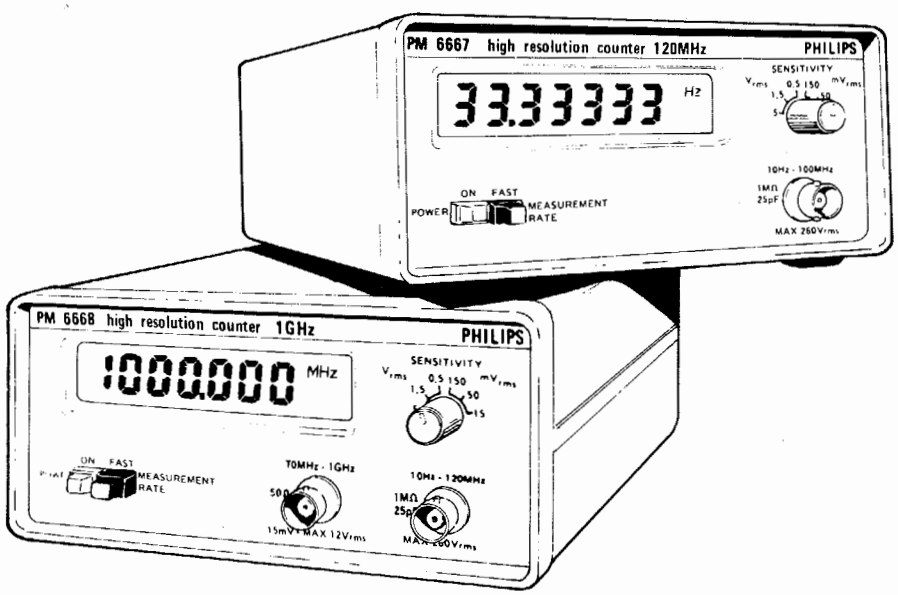






PHILIPS

Notice d'emploi



1. Introduction

Le PM 6667 et le PM 6668 sont des fréquencemètres à micro-processeur offrant une gamme de fréquence respectivement de 10 Hz ... 120 MHz (PM 6667) et de 10 Hz ... 1 GHz (PM 6668).

En mesure de fréquence, l'utilisation du micro-calculateur permet d'éliminer l'erreur traditionnelle de ±1 cycle. En effectuant une mesure en période multiple et en calculant la valeur réciproque, ces compteurs fournissent une très haute résolution même sur des signaux en basse fréquence.

L'avantage de l'utilisation du micro-calculateur dans ces compteurs est la sélection automatique de gammes. Le résultat d'une mesure est toujours affiché avec un maximum de résolution, sans dépassement et avec l'indication appropriée de l'unité: Hz, kHz, MHz et point décimal.

Il offre le choix entre deux cadences de mesure: NORMAL, avec une résolution de 7 chiffres par seconde, ou RAPIDE (fast) avec une résolution de 6 à 7 chiffres toutes les 200 ms. Le mode rapide est utilisé pour l'observation des fréquences variables et pour les règlages de ces fréquences.

Les options suivantes sont offertes: une base de temps plus stable, avec TCXO (version 02), un bloc batterie rechargeable PM 9601 (monté à l'intérieur de l'appareil), une malette de transport PM 9602 et un adaptateur PM 9603 pour montage sur panneau ou rack 19''.

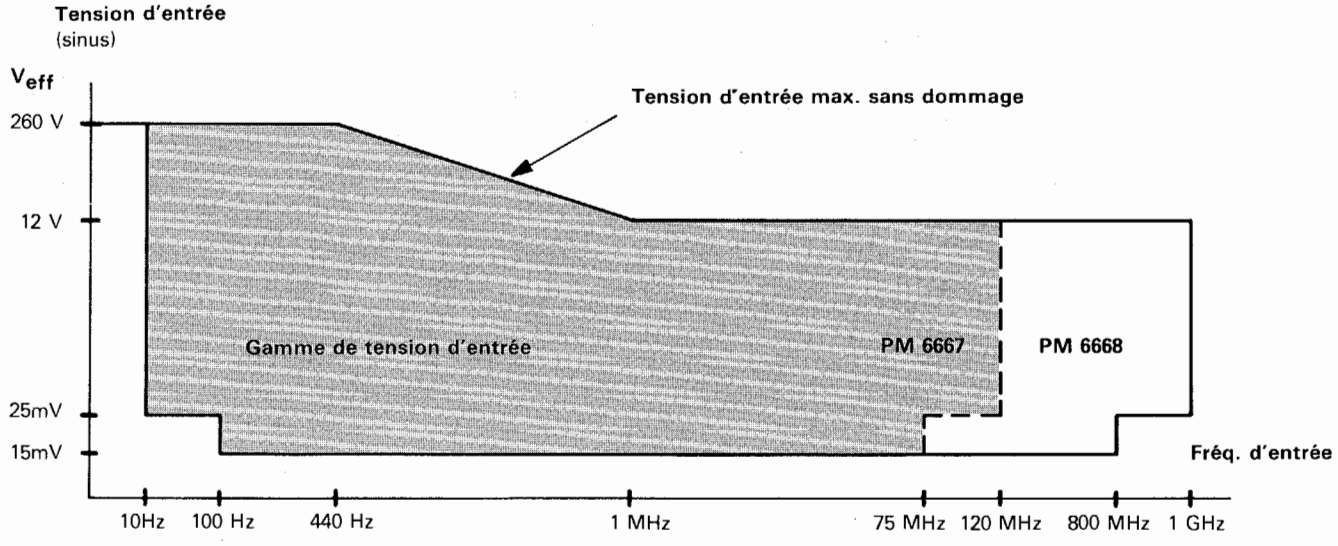
Le cadran à 7 chiffres à cristal liquide contient les voyants de l'unité de mesure et la virgule décimale.

Après la mise en marche, l'appareil effectue un programme d'auto-contrôle. Au cours de celui-ci, si une erreur apparaît, elle est aussitôt détectée et affichée suivant le code de diagnostique.

AVERTISSEMENT

Avant de brancher l'appareil au secteur, lire attentivement les mesures de sécurité décrites en page 17.

2. Caractéristiques techniques



Gamme de fréquence

PM 6667: 10Hz .. . 120MHz
PM 6668: 10Hz ... 1GHz

Sensibilité d'entrée

(en position 15mV$_{eff}$)

Entrée BF: 15mV$_{eff}$ (sinus)
100Hz ... 75MHz

25mV$_{eff}$ (sinus)
10Hz ... 120MHz

45mVc à c pour impulsions de largeur ⩾ 7ns

Entrée RF: (PM 6668 seulement)

15mV$_{eff}$ (sinus)
70MHz ... 800MHz

25mV$_{eff}$ (sinus)
800MHz ... 1GHz

(voir caractéristiques des tensions d'entrées)

Atténuation d'entrée

Entrée BF: x 1 à x 300 en 6 positions
Entrée RF: atténuation automatique

Niveau de déclenchement

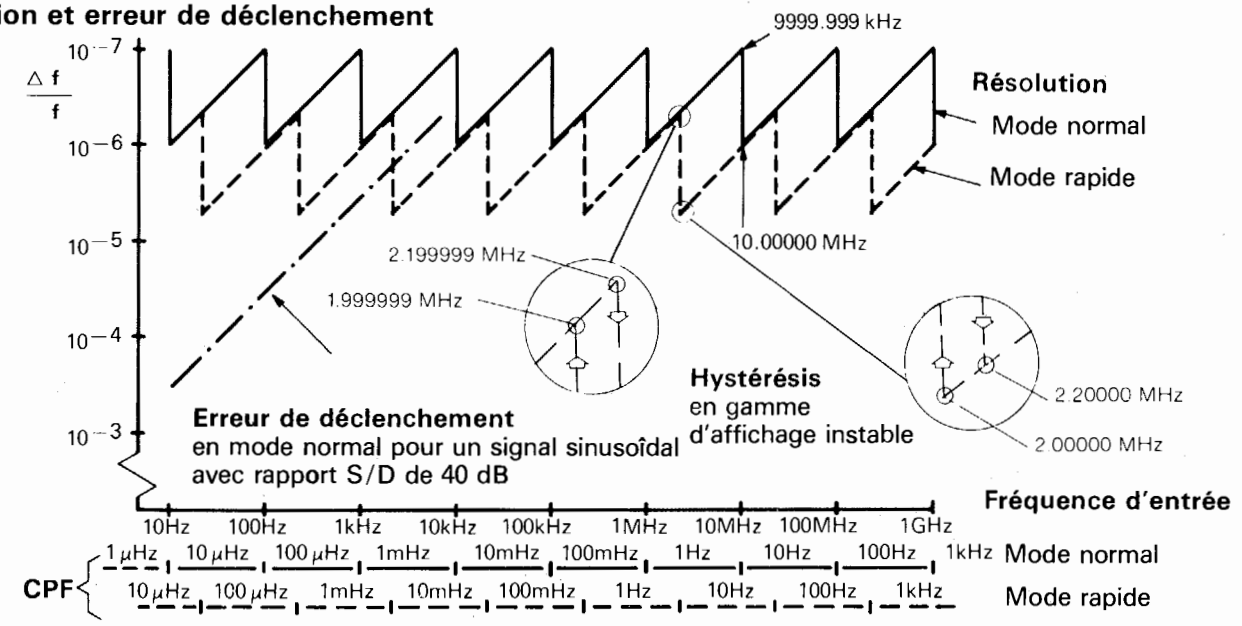
Fixe (+, 0 ou −) la tension est appliqueé automatiquement pour assurer le déclenchement, quels que soient la forme et le rapport cylique du signal.

Couplage: CA

Impédance d'entrée

Entrée BF: 1MΩ// ≈25pF nominal
Entrée RF: 50Ω nominal avec un TOS < 2 (PM 6668 seulement)

Résolution et erreur de déclenchement



Tension d'entrée max.

CC: 300V
CA: 260V_{eff} de 10Hz à 440Hz, descend régulièrement jusqu'à 12V_{eff} à 1 MHz (voir caractéristiques de la tension d'entrée ci-dessus).

Cadence de mesure

Normale (sortie): approx 1 mesure/s
Rapide (entrée): approx 5 mesures/s*

* aux fréquences inférieures à 100Hz, la cadence de mesure descend graduellement en dessous de 1 mesure/s pour réduire l'erreur due au déclenchement.

Affichage

Affichage à cristaux liquides de 7 chiffres de 11,5 mm avec indication de l'unité: Hz, kHz, MHz et "LO-BAT".

Précision (erreur relative de fréquence)

$$\pm \frac{CPF}{\text{Fréquence d'entrée}} \pm \text{err. relat. de déclench.}^{**}$$

± erreur de base de temps

** Erreur relative de déclenchement:

Pour toutes formes d'ondes:

$$\frac{\text{Cadence de mesure}}{\text{Pente du signal (V/s)}} \times \text{tension de bruit c. à c.}$$

Pour ondes sinusoïdales:

$$\frac{\text{Cadence de mesure}}{\text{Fréquence d'entrée} \times \pi \times \text{rapport S/B}}$$

Exemple: pour un rapport S/B de 100 (40dB) et une cadence de mesure de 1 par Sec.

L'erreur de déclenchement est de:

$$\frac{3 \times 10^{-3}}{\text{fréquence d'entrée}}$$

Résolution

Pour le chiffre de poids le plus faible (CPF), la résolution relative est donnée par le graphique ci-haut.

Entrée référence extérieure

Fréquence: 10MHz
Gamme de tension: 0,5V_{eff}...12V_{eff}
Impédance: approx. 2kΩ

Alimentation

115/230V, ±15%, 50 ... 60Hz, 15VA ou par batterie extérieure 12V, ou par bloc batterie interne (option) type PM 9601.

Dimensions et poids

Largeur: 160 mm
Hauteur: 77 mm
Profondeur: 180 mm
Poids: 1,2 Kg

Caractéristiques des bases de temps

Version	/01 (standard)	/02 (TCXO)
Fréquence du cristal	10MHz	10MHz
Stabilité/temps	$\leq 5 \times 10^{-7}$/mois	$\leq 1 \times 10^{-7}$/mois
Stabilité/température		
0 ... 50°C réf. à 25°C	$\leq 1 \times 10^{-5}$	$\leq 1 \times 10^{-6}$
20 ... 30°C réf. à 25°C	$\leq 3 \times 10^{-6}$(typiques)	$\leq 3 \times 10^{-7}$(typiques)

Conditions d'environnement

Température:

Stockage: −40°C ... +70°C
Fonctionnement: 0°C ... +45°C

Pression barométrique/altitude:

Stockage: 15000 m /15,2kN/m^2
Fonctionnement: 5000 m /53,3kN/m^2

Humidité:

10% ... 90% RH
(point de rosée 26°C)

Vibrations: conforme IEC 68 Fc
Chocs: conforme IEC 68 Eb
Manutention: conforme IEC 68 Ec
Transport: conforme NLN - L88

Alimentations:

115/230V, ± 15% 50 ... 60 Hz, 15 VA ou par unité de batterie corporée, en option.

Sécurité

Conforme aux normes IEC 348 et CSA 556 B.

Interférences Secteur

Inférieures à la classe II CENELEC/CISPR.

3. Accessoires

3.1. Accessories standards (fournis avec l'appareil)

— Un cordon secteur.
— Une notice d'emploi.

3.2. Accessoires en option (à commander séparément)

— Une unité de batterie PM 9601.
— Une malette de protection PM 9602.
— Un adaptateur de montage PM 9603 sur panneau/rack 19''.
— Une sonde d'atténuation 10 Mohm, 15 MHz, PM 9236.
— Une sonde d'atténuation 10 Mohm, 250 MHz, PM 8935.
— Une fiche batterie (voir sections 5 et 7.5 de ce manuel).
— Un filtre passe-bas, 50KHz BNC—BNC, PM 9665 B.

4. Unité de batterie PM 9601

4.1. Généralités

La PM 9601 est une unité de batterie rechargeable, pouvant être montée à l'intérieur des compteurs PM 6667 et PM 6668.

Cette unité contient une batterie normale et étanche de 6V, au gel d'acide de plomb. Elle contient en plus, un circuit de protection de charge et de surcharge.

L'unité de batterie est mise en place avec quatre vis, sur un panneau métallique à l'intérieur du coffret. (Voir les instructions de montage.) La batterie étant standard, est disponible sur le marché et chez de nombreux fabricants. Pour obtenir des batteries de rechange, contacter directement votre fournisseur, qui dispose de batteries fraîches et chargées à point.

Fabricant	Pays d'origine	Type	Capacité
Sonnenschein*	Allemagne Féd.	3GX3S	3 Ah
Varta*	Allemagne Féd.	Accu Pb30704063	3 Ah
Gold Gelyte	Etats-Unis	Pb 626-1	2.6 Ah
Elpower	Etats-Unis	Ep 626A-6	2.6 Ah
SAFT*	France	PA 601	4 Ah
Kono	Japon	6-26k	2.6 Ah

* Marque recommandée

AVERTISSEMENT

La capacité des batteries rechargeables se dégrade quand les batteries ne sont pas utilisées ou rechargées fréquemment. Lire alors attentivement les instructions de stockage du fabricant.

4.2. Recharge

La batterie est rechargée automatiquement pendant que le compteur est branché au secteur, même si l'appareil n'est pas en fonctionnement.

Quand l'affichage indique la tension basse (LO BAT), il reste encore 15 minutes de charge avant qu'une recharge soit nécessaire.

En cas d'une panne secteur, la batterie alimente automatiquement le compteur.

Pour prévenir toute décharge indésirable des batteries pendant que le compteur reste hors d'usage, se servir toujours du commutateur de tension pour interrompre l'alimentation, et non le cordon secteur.

Temps de recharge (typique à 20°C): 90% de la capacité totale en 10 heures, et 70% de la capacité totale en 5 heures.

4.3. Stockage

Eviter le stockage de batteries complètement déchargées. Quand l'appareil reste hors d'usage, mettre le commutateur de tension en position fermée ''OFF'' mais laisser l'appareil branché au secteur. La batterie sera alors chargée à point et toujours prête à l'usage. Au cas où la batterie est stockée à l'extérieur de l'appareil, ou quand l'appareil ne peut pas être branché au secteur, il est recommandé de recharger la batterie durant 5 à 10 heures tous les trois mois.

En cas d'une plus longue période de stockage, retirer le fusible dans l'unité de batterie et tenir la batterie au frais et au sec.

AVERTISSEMENT

L'usage permanent et le stockage sous de hautes températures, affectent défavorablement la longévité de la batterie.

Eviter le stockage et l'usage prolongés sous une température supérieure à +40°C et ainsi que la charge sous une température supérieure à +35°C. Pour le stockage à une température de —40°C, la batterie doit être chargée au moins à 75% de sa capacité totale.

Les autres conditions d'environnement sont identiques à celles du compteur.

Poids additionnel de l'unité de batterie: 0.75 Kg.

Fusible: 1.6A action rapide.

5. Batterie externe

Une batterie externe peut être utilisée pour alimenter le compteur. Remplacer le connecteur BNC à l'arrière par une fiche batterie comme décrit à la section 7.5. de ce manuel.

NOTE

Pour obtenir gratuitement une fiche batterie, écrire à:

SA. Philips Industrielle et Commerciale
Division Sciences et Industrie
105 Rue de Paris
93002 BOBIGNY
Tel. 830 11 11

Indiquer s.v.p., les numéros de type et de série de votre appareil.

6. Mesures de sécurité

(conformes à la norme IEC 348)

Avant de brancher l'appareil au secteur, examiner attentivement le coffret, les organes de commande et les connecteurs etc., afin de s'assurer que l'appareil n'a subi aucun dommage durant le transport ou le stockage.

Un défaut quelconque étant constaté, ne pas brancher l'appareil au secteur. Débrancher l'appareil de toute source d'alimentation et décharger tout point de connexion sous haute tension avant d'entreprendre l'entretien ou la réparation.

S'il est inévitable d'enlever les capots du compteur pour procéder à des ajustements ou à une maintenance de l'appareil en opération, alors confier le travail à un personnel qualifié et au courant des risques impliqués.

NOTE

Toutes les pièces se trouvant sur le cotré primaire du transformateur sont reconnues par la CSA, et en cae de besoins devront être remplacées seulement par des pièces détachées d'origine. Le manuel d'entretien fournit les instructions utiles au réglage de la tension.

7. Installation

7.1. Raccordement secteur

Avant de brancher l'appareil au secteur, s'assurer qu'il est adapté à la tension secteur locale. A la livraison l'appareil est adapté à une gamme de 115V ou 230V ±15% selon l'indication sur le panneau arrière. Si l'appareil doit être adapté à une autre gamme de tension, contacter alors votre agent local.

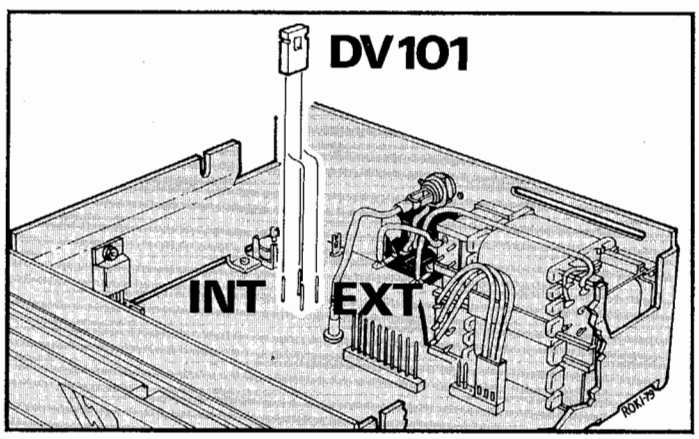
7.2. Mise à la terre

L'appareil est mis à la terre par le cordon secteur à trois conducteurs, enfiché dans une prise secteur comportant une terre. Il est interdit d'avoir recours à d'autres méthodes de mise à la terre.

7.3. Etalon interne et externe

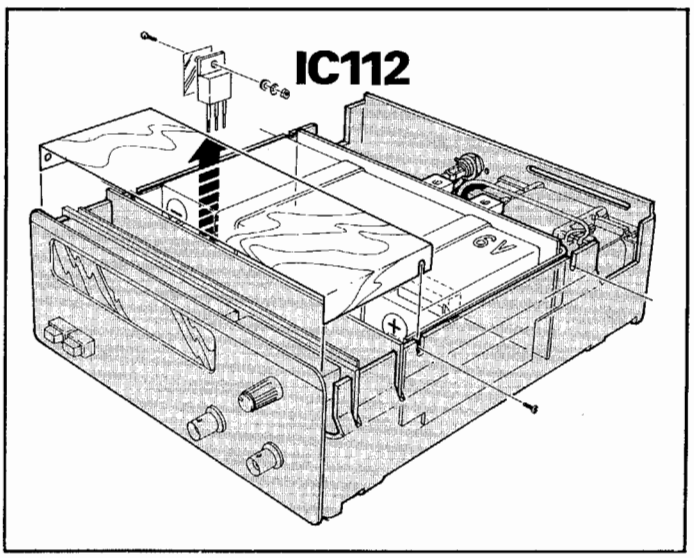
Le compteur peut être adapté à un étalon interne ou externe en utilisant le connecteur amovible DV 101, comme dans l'illustration ci-dessous.

A la livraison, le compteur est adapté à un étalon interne.



7.4 Unité de batterie interne PM 9601

- Enlever le capot du compteur.
- Enlever le panneau de blindage supérieur.
- Enlever le régulateur +5V IC 112 (voir ci-dessous).
- Placer ensuite l'unité de batterie comme dans la figure ci-dessous. Placer les conducteurs allant de la batterie jusqu'à la plaquette cuivrée sur les bords de la batterie.
- Monter le nouveau panneau de blindage comme indiqué dans la figure ci-dessous et en assurer la fixation aux panneaux latéraux du compteur avec 2 vis.
- Assurer enfin la mise en place de l'unité, aux panneaux latéraux du compteur avec des vis.



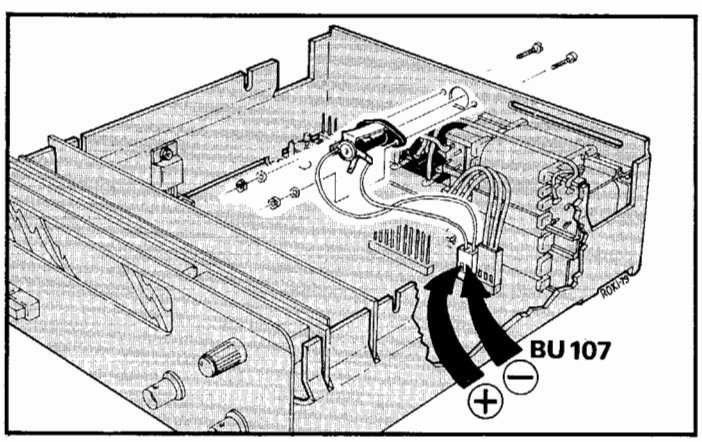
7.5. Fiche batterie externe

Le connecteur BNC à l'arrière, pour étalon externe, peut être remplacé par une fiche batterie pour alimentation batterie externe. La fiche correspond à la norme DIN 45323.

Pour remplacer le connecteur BNC par une fiche batterie, procéder comme suit:

- Détacher le câble coaxial de la plaquette cuivrée, et désouder le conducteur central du connecteur BNC.
- Remplacer le connecteur BNC par une fiche batterie, et enficher le connecteur à double-pôles de façon à ce qu'il coïncide avec la polarité de votre fiche batterie. Voir la figure ci-dessous.

Le connecteur à deux pôles (p/o BU 107) contient une diode de protection contre tout changement de polarité.



8. Organes de commande et Connecteurs

POWER ON

Permet la mise en route (ON) et la mise hors service (OFF) du compteur. ATTENTION: C'est un commutateur secondaire d'alimentation. Même en position POWER OFF le compteur contient toujours des conducteurs et pièces sous tension. Pour interrompre complètement l'alimentation du compteur, débrancher le cordon secteur. En cas d'une panne secteur, la batterie alimente automatiquement le compteur.

MODE DE MESURE (measurement rate)

Réglage du mode de mesure sur un des deux cadences de mesure NORMAL (position relâchée) ou FAST (rapide, position enfoncée). NORMAL signifie 1 mesure/seconde et FAST (rapide) signifie 5 mesures/seconde. En mode FAST (rapide) la vitesse diminuera jusqu'à 1 mesure/seconde aux fréquences basses telle que 10Hz.

SENSITIVITY (sensibilité)

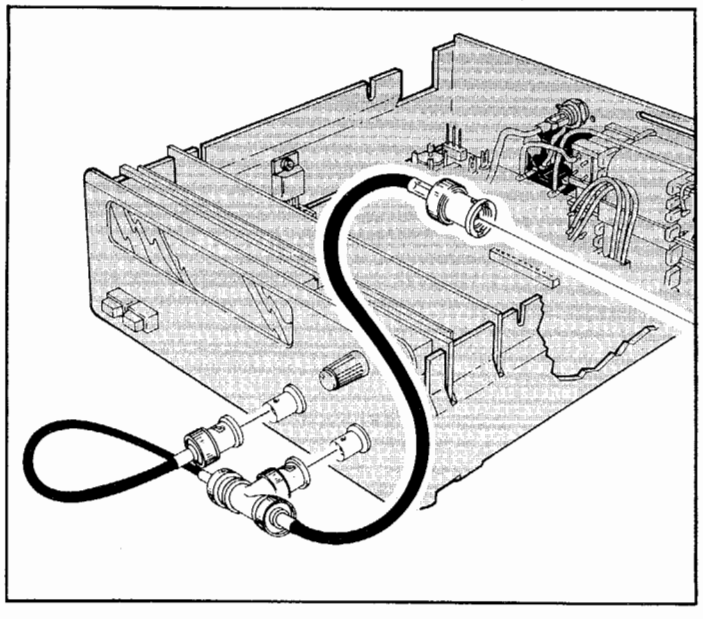
Réglage de la sensibilité d'entrée en 6 gammes; de 15mV$_{eff}$ à 5 V$_{eff}$.

NOTE: Pour réduire toute influence de bruits et d'interférences, ne jamais augmenter la sensibilité inutilement.

Entrée RF (PM 6668 seulement)

Une entreé à basse impédance (50 ohm) et à couplage capacitif, pour les signaux dont les fréquences sont de 70MHz à 1GHz.

Le micro-ordinateur du compteur détecte la présence d'un signal RF et le sélectionne automatiquement, quand le signal d'entrée est suffisamment important pour le comptage. En conséquence il est possible de coupler simultanément le même signal aux deux entrées, par un connecteur-T (voir la figure ci-dessous).



Le compteur sélectionnera alors automatiquement, l'une des deux entrées, selon le changement de fréquences, ex. — pour la mesure en balayage fréquences.

Pour de plus amples détails sur le signal d'entrée, voir Caractéristiques Techniques.

Entrée BF

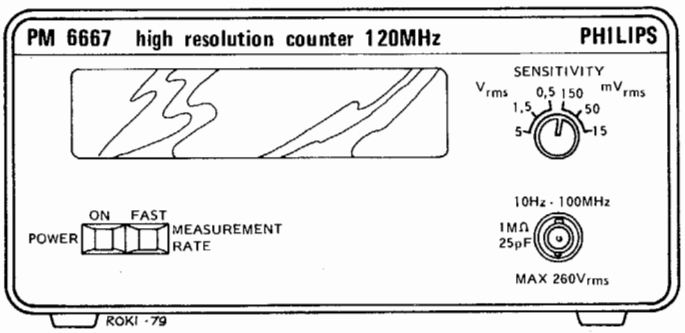
Une entrée à haute impédance (1 Mohm) et à couplage capacitif, pour les signaux dont les fréquences sont de 10Hz à 120MHz. Un circuit à auto-déclenchement assure le déclenchement correct sur les sinusoidales et les impulsions, quelque soit le rapport cyclique.

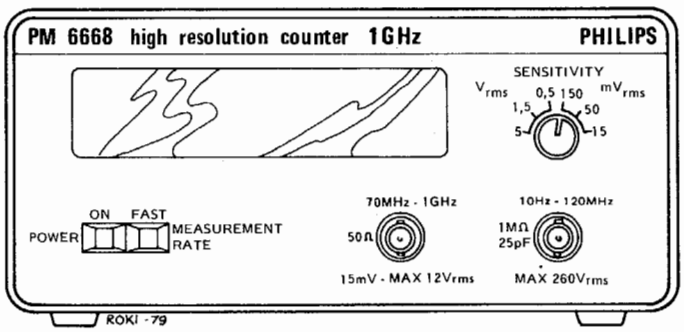
ETALON EXTERNE ou BATTERIE

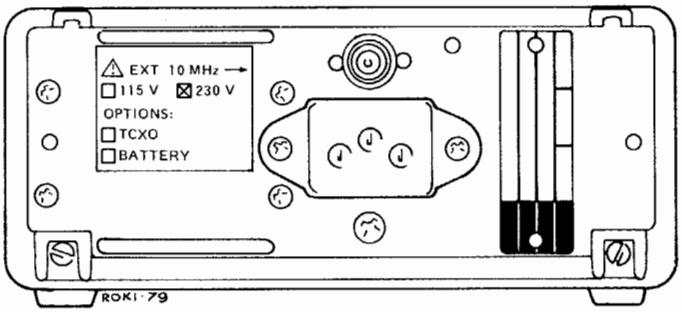
Entrée BNC pour étalon base de temps externe, ou comme option supplémentaire, fiche batterie pour batterie externe.

Douille tension secteur

Entrée tension secteur. Se servir toujours du cordon secteur à trois conducteurs fourni avec le compteur.

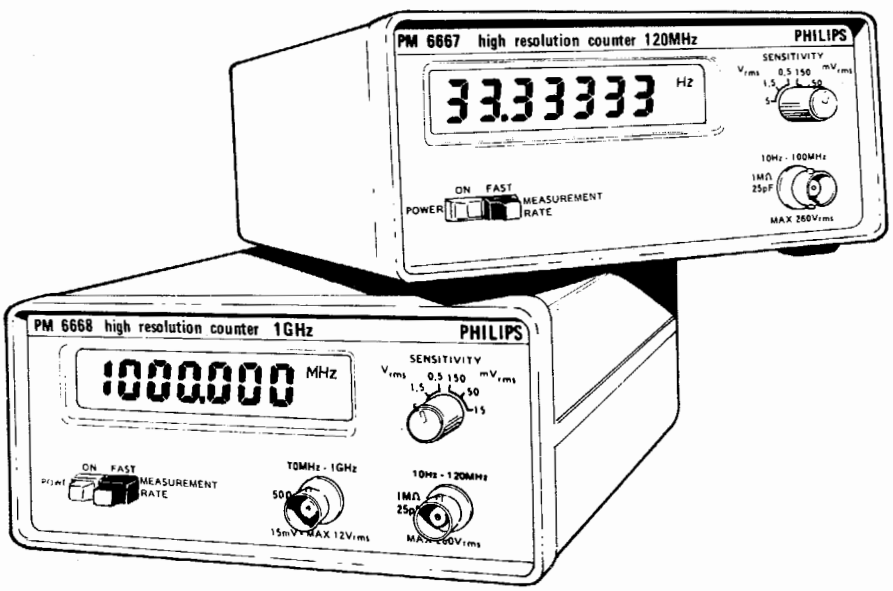






PHILIPS

Bruksanvisning



1. Inledning

PM 6667 och PM 6668 är mikrodatorbaserade frekvensräknare för frekvensområdet 10 Hz ... 120 MHz (PM 6667) och 10 Hz ... 1 GHz (PM 6668).

Mikrodatorn i dessa räknare öppnar nya möjligheter för frekvensmätningar. Felmarginalen är nämligen ±0, mot traditionellt ±1. Genom att mäta ett multipelt periodantal och beräkna reciprokvärdet möjliggörs frekvensmätningar med hög upplösning även vid lågfrekventa signaler.

Ytterligare en fördel med PM 6667 och PM 6668 är automatisk inställning på rätt mätområde. Mätresultaten visas alltid med maximal upplösning utan överlopp, och med korrekt angivelse av Hz, kHz, MHz samt decimaltecken.

Det finns två mäthastigheter att välja mellan: NORMAL med 7-siffrig upplösning varje sekund eller FAST med 6-siffrig eller 7-siffrig upplösning varje 200 ms. Driftssättet FAST används för mätning av växlande frekvenser vid bl a tuning.

Följande extra tillbehör kan levereras: en stabilare tidsbas med TCXO (/02 version), ett laddningsbart batteri PM 9601 för montering i räknarna, en slagtålig bärväska PM 9602 och 19''-adapter för stativ- och panelmontage.

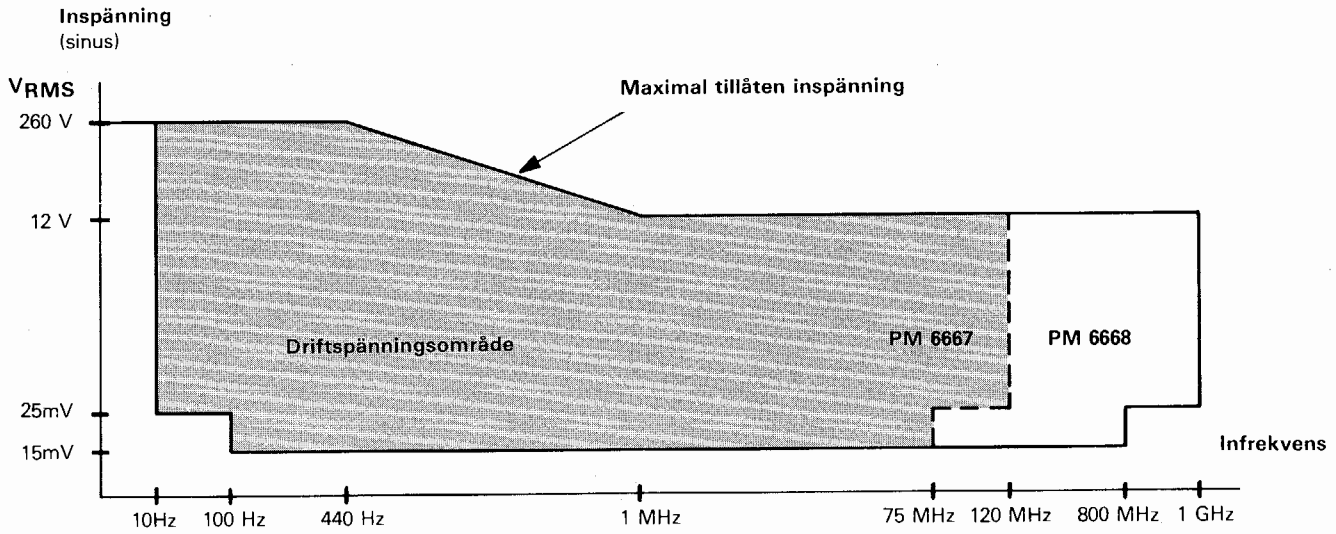
Räknarnas 7-siffriga display anger även mätenhet och decimaltecken.

Efter inkoppling genomför räknaren en självkontroll. Ev fel som därvid upptäcks indikeras med hjälp av en diagnostisk kod (Error 1—6).

OBS!

Läs igenom säkerhetsbestämmelserna på sida 23 innan instrumentet ansluts till nätspänningen!

2. Teknisk specifikation



Frekvensområde

PM 6667: 10Hz ... 120MHz
PM 6668: 10Hz ... 1GHz

Ingångskänslighet

(vid inställning på $15mV_{eff}$)

LF-ingång: $15mV_{eff}$ sinus; 100Hz ... 75MHz

$25mV_{eff}$ sinus; 10Hz ... 120MHz

$45mV_{t\text{-}t}$ för pulser med pulstid ⩾ 7ns

HF-ingång: $15mV_{eff}$ sinus;
(PM 6668) 70MHz ... 800MHz

$25mV_{eff}$ sinus; 800MHz ... 1GHz

(se inspänningskarakteristik ovan)

Ingångsdämpning

LF-ingång: x 1 till x 300 i 6 steg
HF-ingång: automatisk dämpning

Triggnivå

En fast spänning (+, 0 eller —) ger automatiskt korrekt triggning vid godtyckliga kurvformer och pulsförhållanden (pulskvoter).

Koppling: AC

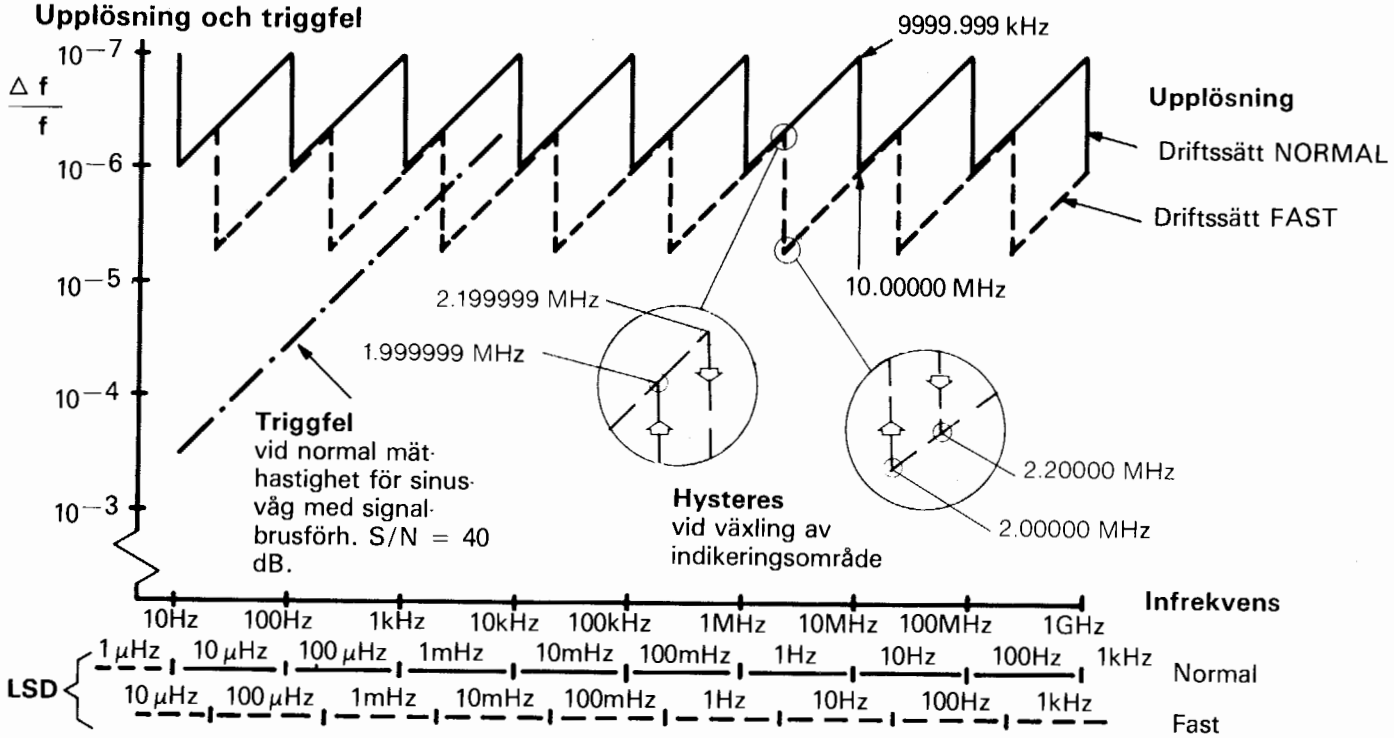
Ingångsimpedans

LF-ingång: 1MΩ// ≈ 25pF
HF-ingång: 50Ω nominellt med VSWR < 2 (endast PM 6668)

Max. tillåten inspänning

DC: 300V
AC: $260V_{eff}$ vid ⩽ 440Hz, minskande till $12V_{eff}$ vid 1 MHz (se inspänningskarakteristik ovan)

Upplösning och triggfel



Mäthastighet

Normal: ca 1 mätning/s
Fast: ca 5 mätningar/s; vid frekvenser lägre än 100 Hz minskar mäthastigheten stegvis ned till en mätning per sekund för att reducera triggfelets inverkan.

Indikering

Flytande kristalldisplay (LCD), 7 siffror, höjd 11,5 mm.Indikering av mätenheterna Hz, kHz och MHz samt LO BAT (urladdat batteri).

Max mätfel (relativt frekvensfel)

$$\pm \frac{\text{LSD}}{\text{infrekvens}} \pm \text{rel. triggfel} \pm \text{tidsbasfel}$$

Rel. triggfel:

För godtyckliga vågformer:

$$\frac{\text{Mäthastighet}}{\text{Signalens flankbranthet V/s} \times \text{topp-till-topp brusspänning}}$$

För sinusformade signaler:

$$\frac{\text{Mäthastighet}}{\text{Infrekvens} \times \pi \times \text{S/N}}$$

Exempel: vid S/N (signal-brusförhållande) = 100 (40 dB) och 1 mätning/s är triggfelet lika med

$$\frac{3 \times 10^{-3}}{\text{infrekvens}}$$

Upplösning

Betr minst signikanta siffran (LSD, least significant digit) och relativ upplösning, se diagrammet ovan.

Extern referensingång

Frekvens:	10MHz
Inspänning:	$0{,}5V_{eff}$...$12V_{eff}$
Ingångsimpedans:	ca. 2kΩ

Nätanslutning, effektförbrukning

115/230V, ±15%, 50 ... 60Hz; 15VA eller genom inbyggt batteri, PM 9601, eller externt 12V-batteri.

Säkerhet

Enl IEC 348 och CSA 556 B.

Nätstörningar

Bättre än klass II CENELEC/CISPR

Dimensioner och vikt

Längd: 160 mm
Höjd: 77 mm
Djup: 180 mm
Vikt: 1,2 kg

Omgivningsfaktorer

Temperatur:

Lagring:	−40°C ... +70°C
Drift:	0°C ... +45°C

Höjd/lufttryck:

Lagring: 15000 m /15,2kN/m²
Drift: 5000 m /53,3kN/m²

Fuktighet:

10% ... 90% rel luftfuktighet (daggpunkt 26°C)

Vibrationsprov:	enl IEC 68 Fc
Slagprov:	enl IEC 68 Eb
Hanteringsprov:	enl IEC 68 Ec
Transportprov:	enl NLN - L88

Tidsbaskarakteristik

Tidsbas	/01 (standard)	/02 (TCXO)
Extern frekvens	10MHz	10MHz
Åldring	$\leq 5 \times 10^{-7}$ /månad	$\leq 1 \times 10^{-7}$ /månad
Temperaturstabilitet		
0 ... 50°C, i förh. till 25°C	$\leq 1 \times 10^{-5}$	$\leq 1 \times 10^{-6}$
20 ... 30°C, i förh. till 25°C	$\leq 3 \times 10^{-6}$ (typiskt)	$\leq 3 \times 10^{-7}$ (typiskt)

3. Tillbehör

3.1. Standardtillbehör
(följer med instrumentet)

- Nätkabel.
- Instruktionshäfte.

3.2. Extra tillbehör
(att beställas separat)

- PM 9601 batterienhet.
- PM 9602 bärväska.
- PM 9603 19" adapter för rackmontage.
- PM 9665 B 50kHz-lågpassfilter, BNC–BNC.
- PM 9236 15 MHz, 10 Mohm-testprob (mätkropp).
- PM 8935 250MHz, 10 Mohm-testprob.
- Batterijack (se avsnitt 5 och 7.5 i detta instruktionshäfte).

4. Batterienhet PM 9601

4.1. Allmänt

PM 9601 är en laddningsbar batterienhet avsedd att monteras i räknarna PM 6667 och PM 6668.

Enheten innehåller ett 6 V gastätt blybatteri samt styrkretsar för laddning och skydd mot överladdning.

Batterienheten fästs med fyra skruvar på instrumentets inre metallram. (Se monteringsanvisningarna)

Batteriet är av standardtyp och det går att använda ett flertal olika märken. Färska och fullt uppladdade reservbatterier finns att köpa i fackhandeln.

Tillverkare	Ursprungs-land	Typ	Kapacitet
Sonnenschein*	V-tyskland	3GX3S	3 Ah
Varta*	V-tyskland	Accu Pb30704063	3 Ah
Gold Gelyte	USA	Pb 626-1	2.6 Ah
Elpower	USA	Ep 626A-6	2.6 Ah
SAFT*	Frankrike	PA 601	4 Ah
Kono	Japan	6-26k	2.6 Ah

* rekommenderat märke

OBS!

Kapaciteten hos laddningsbara batterier avtar om batterierna inte används kontinuerligt eller omladdas med jämna mellanrum. Läs därför noga igenom lagringsföreskrifterna.

4.2. Laddning

Batteriet laddas automatiskt när instrumentet är anslutet till nätet och huvudbrytaren står på OFF.

När displayet visar "LO BAT" finns det kapacitet kvar för 15 minuters drift innan batteriet behöver laddas om.

Vid nätspänningsbortfall kopplar räknaren automatiskt om till batteridrift.

Använd alltid huvudbrytaren för att stänga av instrumentet, inte nätkabeln! På så sätt undviker man att batteriet laddar ur när räknaren inte används.

Laddningstid (typiskt värde vid 20°C) upp till full kapacitet är 10 timmar, upp till 70% kapacitet 5 timmar.

4.3. Lagring

Undvik att lagra helt urladdade batterier.

När instrumentet inte används, ställ huvudbrytaren på OFF men låt instrumentet vara anslutet till nätet. Batteriet är då hela tiden fullt uppladdat och driftklart. Ifall instrumentet ej kan vara anslutet till nätet, eller om batterienheten lagras utanför instrumentet, rekommenderar vi att batteriet laddas om var 3:e månad under 5–10 timmar.

Om batteriet skall lagras under längre tid, ta bort säkringen i batterienheten och förvara batteriet på sval och torr plats.

OBS!

Ständig användning och lagring vid höga temperaturer minskar batteriets livslängd.

Långvarig lagring och drift över +40°C samt laddning vid över +35°C bör undvikas.

Före lagring vid –40°C skall batteriet laddas upp till minst 75% av den fulla kapaciteten.

Övriga omgivningsfaktorer är desamma som för själva räknaren.

Vikt: 0,75 kg.

Säkring: 1,6A snabb.

5. Externt batteri

Räknaren-kan även drivas med externt batteri. Byt i så fall BNC-intaget på baksidan mot ett batterijack (se beskrivning i avsnitt 7.5 i detta instruktionshäfte).

ANM

Batterijacket inkl stickpropp kan beställas kostnadsfritt hos:

Philips Elektronikindustrier AB
Div. I Supply Center Service
175 88 JÄRFÄLLA

V.g. ange instrumentets typnummer och serienummer.

6. Säkerhets-bestämmelser

(enl IEC 348)

Innan ni ansluter instrumentet till nätet: se över instrumenthuset, kontroller, anslutningar osv och kontrollera att inga transportskador finns.

Om skador upptäcks får instrumentet inte anslutas till nätet. Det skall skiljas från samtliga spänningskällor innan några reparations- eller underhållsarbeten företas.

Ändringar eller reparationer som måste utföras när instrumentet är i drift och skyddslocken borttagna, får endast utföras av kunnig fackman som är medveten om riskerna.

OBS!

Samtliga delar på transformatorns primärsida är godkända av CSA och bör endast ersättas med originalreservdelar.

7. Handhavande

7.1. Nätanslutning

Kontrollera först att instrumentet är inställt på den lokala nätspänningen. Inställningen vid leverans (115 V eller 220 V ± 15%) finns angiven på instrumentets baksida. Om räknaren behöver inställas på en annan spänning än den angivna, kontakta er serviceorganisation.
Dessutom innehåller servicehandboken detaljerade anvisningar.

7.2. Jordning

Instrumentet är skyddsjordat via 3-ledarnätkabeln som skall anslutas till vägguttag med jorddon.

Ingen annan form av skyddsjordning är tillåten.

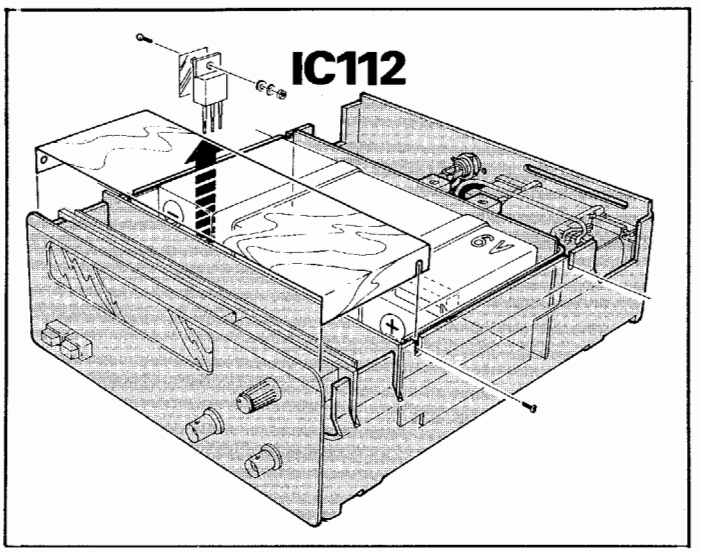
7.3. Intern och extern standard

Genom omkoppling av jumpern DV 101 kan räknaren ställas in på antingen extern eller intern standard. (Se fig. nedan.)

Vid leverans är räknaren inställd på intern standard.

7.4 Montering av intern batterienhet PM 9601

- Ta bort instrumentkåpan.
- Ta bort övre skyddslocket.
- Ta bort +5V-regulatorn IC 112 (se fig. nedan).
- Sätt i batterienheten som på bilden nedan. Placera ledningarna från batteriet till kretskortet utmed batteriets kanter.
- Sätt på det nya skyddslocket som bilden visar och fäst det på instrumentets sidoväggar med 2 skruvar.
- Skruva fast batterienheten på instrumentets sidor.



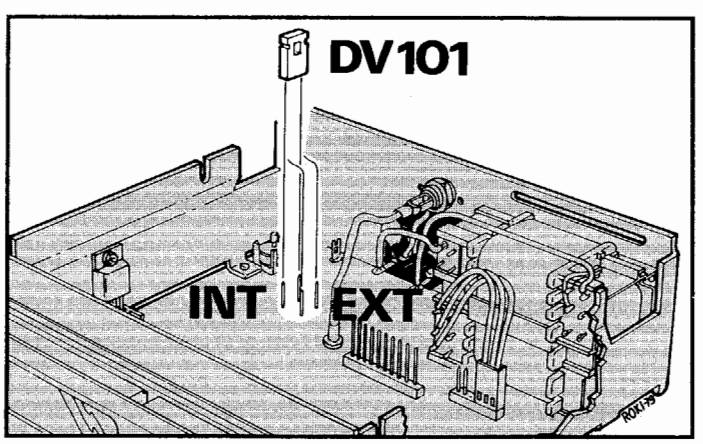
7.5. Jack för externt batteri

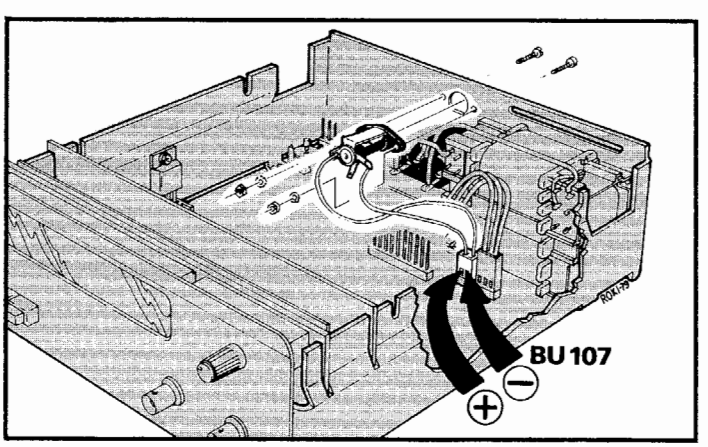
Det bakre BNC-intaget för extern standard kan bytas ut mot ett batterijack för anslutning till ett externt batteri. Jacket passar DIN 45323.

Gör så här för att ersätta BNC-intaget med batterijack:

- Lösgör koaxialkabeln från kretskortet och löd loss innerledaren från BNC-kontakten.
- Byt ut BNC-kontakten mot batterijacket och anslut den tvåpoliga kontakten så att den stämmer överens med polariteten på den yttre spänningskällan.

Den 2-poliga kontakten (p/o BU 107) är diodskyddad för att förhindra skada om instrumentet ansluts med fel polaritet.





8. Kontroller och ingångar

POWER ON

För till- och frånkoppling. OBS! Detta är en sekundär huvudbrytare. Instrumentet har därför spänningsförande delar även när huvudbrytaren står i frånkopplat läge POWER OFF. För att skilja instrumentet helt från nätet skall nätkabeln dras ur.

Vid nätspänningsbortfall kopplar räknaren automatiskt om till batteridrift.

MEASUREMENT RATE

Inställning på en av två mäthastigheter: NORMAL eller FAST (tryckknappen intryckt).

NORMAL innebär ca 1 mätning/s och FAST ca 5 mätningar/s. Mäthastigheten med driftssättet FAST minskar vid lägre frekvenser och är ca 1 mätning/s vid 10 Hz.

SENSITIVITY

Inställning av ingångskänsligheten i sex steg mellan 15mV$_{eff}$ och 5 V$_{eff}$.

ANM. Välj aldrig högre känslighet än nödvändigt för att så mycket som möjligt reducera inverkan av brus och störningar.

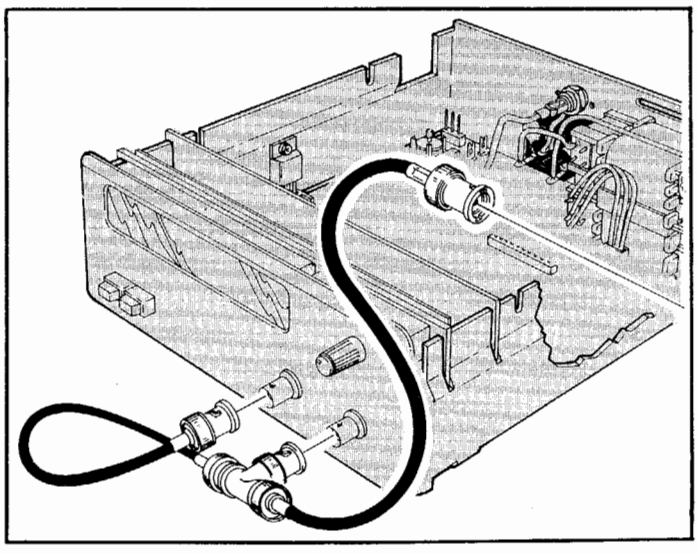
HF-ingång (PM 6668)

Lågohmig (50 ohm), AC-kopplad ingång för sinussignaler med frekvenser 70MHz till 1GHz.

Räknarens mikrodator registrerar förekomsten av ev HF-signaler och väljer automatiskt denna ingång om infrekvensen är tillräckligt hög och med tillräcklig impedans. Samma signal kan därför påföras båda ingångarna med hjälp av ett T-stycke. Se fig. nedan.

Räkaren kopplar sedan automatiskt om mellan LF- och HF-ingångarna när frekvensen växlar som t ex vid mätning av frekvenssvep.

Mera information om ingångssignalen finns i avsnitt 2, tekniska specifikationer.



LF-ingång

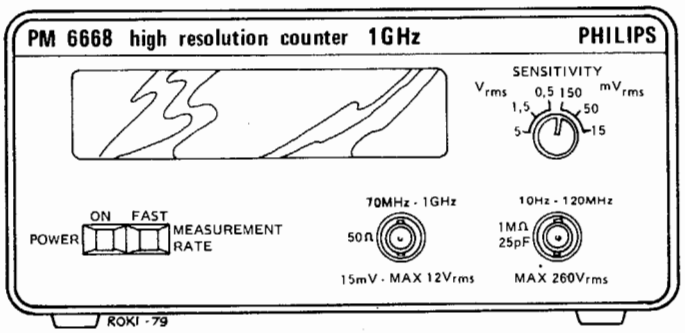
Högohmig (1 Mohm), AC-kopplad ingång för signaler med frekvenser 10Hz till 120MHz. Ingången har **auto-triggkrets** som ger korrekt triggning på både sinusvågor och pulser med godtycklig pulskvot.

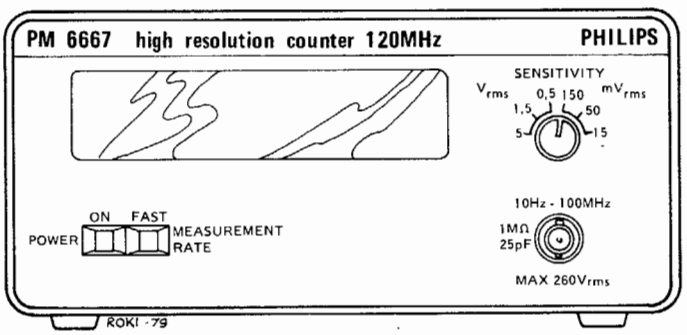
EXTERN STANDARD eller BATTERI

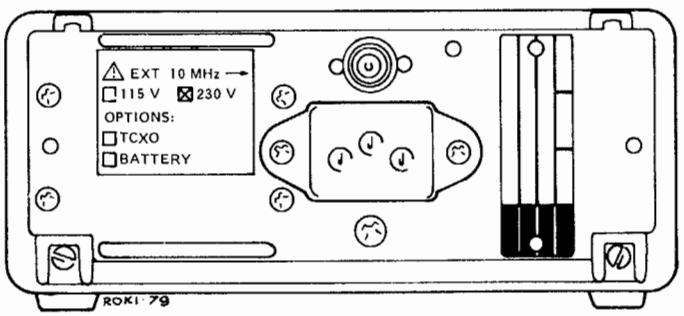
BNC-ingången för extern tidsbas eller — som extra tillbehör — jack för externt batteri.

Nätanslutning

Nätspänningsingång. Använd alltid 3-ledarnätkabeln som levereras tillsammans med instrumentet.

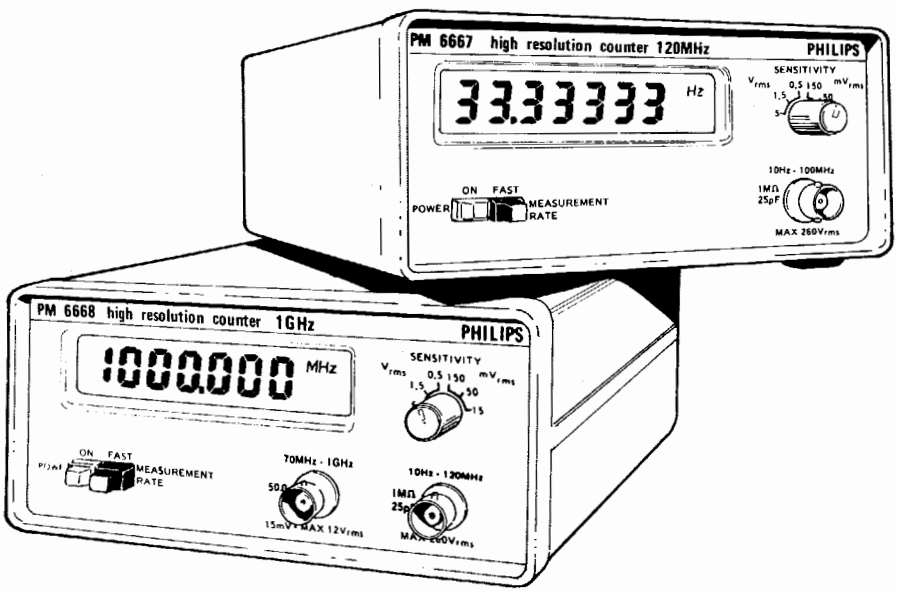






PHILIPS

Istruzioni per l'uso



1. Introduzione

I PM 6667 e PM 6668 sono due contatori di frequenza basati su microprocessore, per misure di frequenza da 10 Hz ... a 120 MHz (PM 6667) e da 10 Hz ... 1 GHz (PM 6668).

L'impiego del microprocessore consente un nuovo sistema nelle misure di frequenze che elimina il tradizionale errore di ±1 ciclo. Eseguendo la misura di un multiplo del periodo e calcolandone il valore reciproco, questi contatori realizzano misure di frequenze con elevatissima risoluzione su segnali di bassa frequenza.

Altra prerogativa di questi contatori è la selezione automatica della gamma e che il risultato quindi viene sempre rappresentato automaticamente, con la massima risoluzione possibile senza fuori-scala e con la relativa indicazione di Hz, kHz, MHz e punto decimale.

Si può scegliere tra due cadenze di misura: NORMAL, una al secondo con risoluzione sempre di 7 cifre oppure FAST, cinque al secondo, con risoluzione di 6 o 7 cifre; questo modo viene usato per misurare frequenze che cambiano, per esempio in fase di tarature.

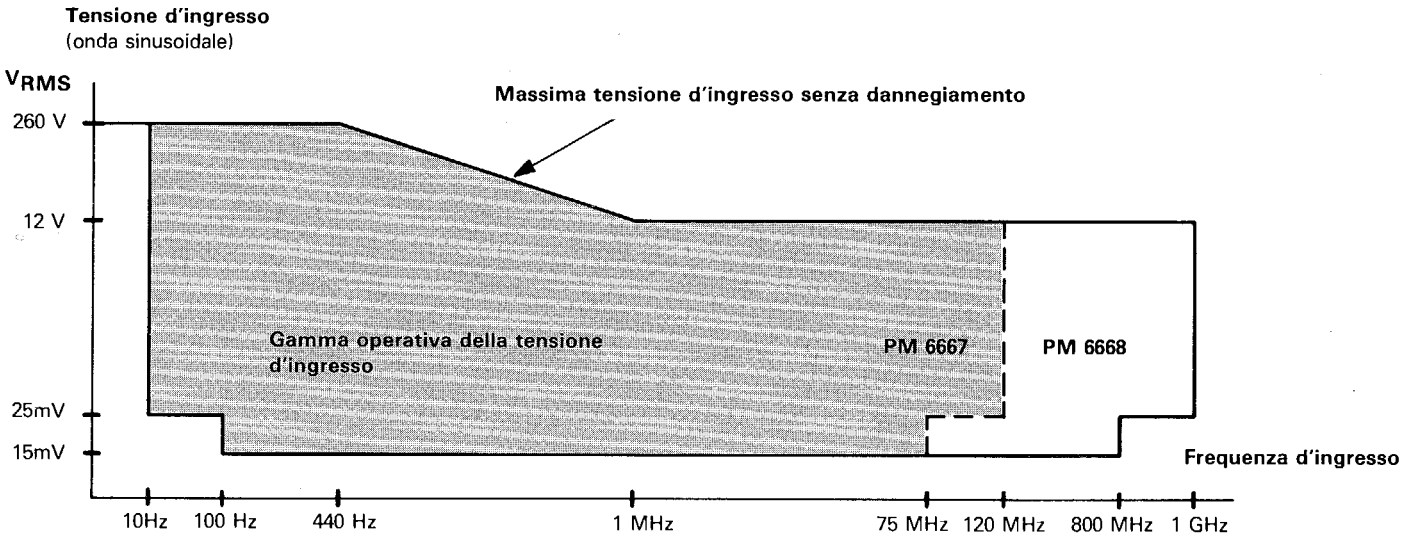
Sono disponibili le seguenti opzioni: una versione con base tempi più stabile con TCXO (versione/02), un'unità PM 9601 con batteria ricaricabile montabile entro il contatore, una valigetta PM 9602 in materiale antiurto (ABS) ed un adattatore PM 9603 per montaggio su rack 19''.

L'indicatore a 7 cifre a cristalli liquidi (LCD) è completo di unità di misura e punto decimale. Ogni volta che si accende il contatore viene eseguita una routine di prova e, se vi fosse un guasto, apparirà sul display un'indicazione secondo un codice diagnostico.

ATTENZIONE

Prima di collegare lo strumento alla rete, leggere le norme di sicurezza a pag. 29.

2. Specifica tecnica



Gamma di frequenza

PM 6667: 10Hz .. . 120MHz
PM 6668: 10Hz ... 1GHz

Sensibilità d'ingresso
(posizione 15mV$_{eff}$)

Ingresso BF: 15mV$_{eff}$ sinusoidale; 100Hz ... 75MHz

25mV$_{eff}$ sinusoidale; 10Hz ... 120MHz

45mV$_{p-p}$ per impulsi con una durata ⩾ 7ns

Ingresso RF: (solo PM 6668)

15mV$_{eff}$ sinusoidale; 70MHz ... 800MHz

25mV$_{eff}$ sinusoidale; 800MHz ... 1GHz

(vedere caratteristiche di tensione d'ingresso)

Attenuazione d'ingresso

Ingresso BF: x 1 a x 300 in 6 posizioni
Ingresso RF: attenuazione automatica

Livello di trigger

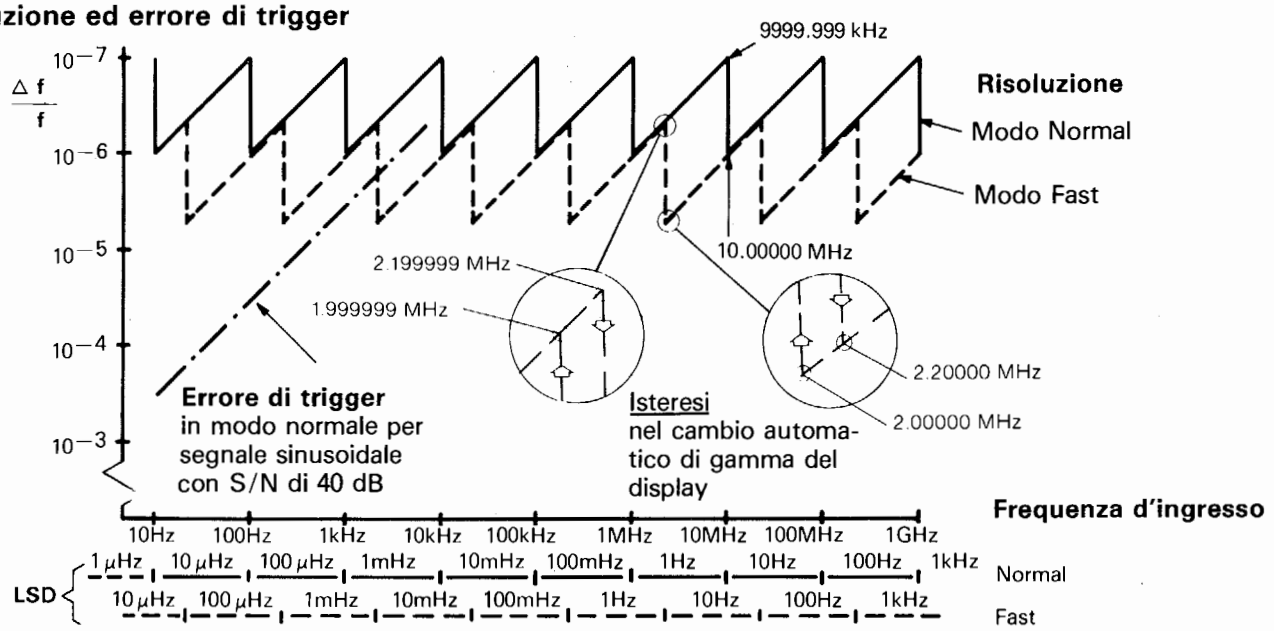
Una tensione fissa (+, 0 o −) viene applicata automaticamente in modo di assicurare un trigger adeguato per ogni forma d'onda e per ogni rapporto ciclico.

Accoppiamento: AC

Impedenza d'ingresso

Ingresso BF: 1MΩ// ≈ 25pF
Ingresso RF: 50Ω nominale con VSWR < 2 (solo PM 6668)

Risoluzione ed errore di trigger



Tensione massima d'ingresso senza danno

DC: 300V
AC: $260V_{eff}$ a ⩽ 440Hz scendendo a $12V_{eff}$ a 1 MHz (vedi caratteristiche di tensione di ingresso alla pagina precedente).

Cadenza di misura

Normal: (out) ca. 1 misura/sec.
Fast: (in) ca. 5 misure/sec.*

* con frequenze inferiori ai 100 Hz la cadenza di misura rallenta gradualmente fino ad una misura per secondo in modo da ridurre l'influenza dell'errore di trigger.

Display

7 cifre, 11,5 mm; display a cristalli liquidi con indicazione unità Hz, kHz, MHz e LO BAT.

Imprecisione (errore relativo di frequenza)

$$\pm \frac{\text{LSD}}{\text{Frequenza d'ingresso}} \pm \text{errore relativo di trigger.}^{**}$$

± Errore base dei tempi

** Errore relativo di trigger:

Per ogni forma d'onda:

$$\frac{\text{Misure per secondo}}{\text{Pendenza segnale (V/s)}} \times \text{tensione rumore picco picco.}$$

Per onde sinusoidali:

$$\frac{\text{Misure per secondo}}{\text{Frequenza ingresso} \times \pi \times S/N}$$

Esempio: per un rapp. S/N di 100 (40dB) ed una cadenza di misura di una misura/sec.

L'errore di trigger è:

$$\frac{3 \times 10^{-3}}{\text{frequenza d'ingresso}}$$

Risoluzione

Per la cifra meno significativa (LSD) e relativa risoluzione, vedi grafico qui sopra.

Ingresso standard esterno

Frequenza:	10MHz
Tensione:	$0,5V_{eff}...12V_{eff}$
Impedenza d'ingresso:	ca. 2kΩ

Alimentazione richiesta

115/230V, ±15%, 50 ... 60Hz; 15VA oppure da alimentatore a batteria ricaricabile incorporato (PM 9601 opzionale) oppure una alimentazione esterna di 12 V c.c.

Sicurezza

Secondo IEC 348 e CSA 556B.

Interferenze linea

Nei limiti di classe II CENELEC/CISPR

Ingombro e peso

Larghezza: 160 mm (6,3")
Altezza: 77 mm (3")
Profondità: 180 mm(7,1")
Peso: 1,2 Kg (2,6lb.)

Condizioni ambientali

Temperatura:

Immagazzinaggio: −40°C ... +70°C
Funzionamento: 0°C ... +45°C

Altitudine/pressione barometrica:

Immagazzinaggio: 15000 m/(50000 ft) /15,2kN/m^2
Funzionamento: 5000 m/(15000 ft) /53,3kN/m^2

Umidità:

10% ... 90% RH
(punto di rugiada 26°C)

Prova vibrazione:	secondo IEC 68 Fc
Prova urto:	secondo IEC 68 Eb
Prova maneggevolezza:	secondo IEC 68 Ec
Prova trasporto:	secondo NLN - L88

Caratteristiche base di tempo

Versione base di tempo	/01 (standard)	/02 (TCXO)
Frequenza	10MHz	10MHz
Invecchiamento	⩽ 5×10^{-7}/mese	⩽ 1×10^{-7}/mese
Stabilità temperatura		
0 ... 50°C relativo a 25°C	⩽ 1×10^{-5}	⩽ 1×10^{-6}
20 ... 30°C relativo a 25°C	⩽ 3×10^{-6} (tipico)	⩽ 3×10^{-7} (tipico)

3. Accessori

3.1. Accessori standard
(consegnati con lo strumento)

- Cavo alimentazione rete.
- Manuale con istruzioni.

3.2. Accessori a richiesta
(da ordinare separatamente)

- Alimentatore a batterie PM 9601.
- Valigetta per trasporto PM 9602.
- Pannello adattatore per montaggio a rack 19" PM 9603.
- Filtro passa basso 50 kHz, BNC-BNC, PM 9665B.
- Sonda attenuata 10 Mohm, 15 MHz, PM 9236.
- Sonda attenuata 10 Mohm, 250 MHz, PM 8935.
- Presa a jack (vedi sezione 5 e 7.5 di questo manuale).

4. Alimentatore a batterie ricaricabili PM 9601

4.1. Informazioni Generali

Il PM 9601 è un alimentatore a batterie ricaricabili per montaggio all'interno dei contatori PM 6667 e PM 6668.

L'unita contiene una batteria a 6 V ermetica a "Solid gel" (vedi tabella) ed il relativo circuito per la ricarica controllata e protetta.

L'unita viene fissata con quattro viti nel contenitore metallico interno (vedi istruzioni di montaggio).

La batteria è di tipo standard ed è reperibile presso numerosi fabbricanti di batterie. Per ottenere batterie di ricambio contattare direttamente il Vs. abituale fornitore che ha normalmente batterie fresche e cariche:

Fabbricante	Nazione di origine	Tipo	Capacità
Sonnenschein*	Germania Fed.	3GX3S	3 Ah
Varta*	Germania Fed.	Accu Pb30704063	3 Ah
Gold Gelyte	Stati Uniti	Pb 626-1	2.6 Ah
Elpower	Stati Uniti	Ep 626A-6	2.6 Ah
SAFT*	Francia	PA 601	4 Ah
Kono	Giappone	6-26K	2.6 Ah

* raccomandata

ATTENZIONE

La capacità delle batterie ricaricabili degrada qualora non vengano usate e ricaricate frequentemente. Leggere quindi attentamente le istruzioni per la tenuta a magazzino.

4.2. Ricarica

La batteria si ricarica automaticamente quando il contatore è collegato alla rete e l'interruttore di accensione è su "OFF".

Dal momento in cui appare sul display la scritta "LO BAT" si hanno ancora 15 minuti di funzionamento prima della necessità di ricarica.

Il contatore commuta automaticamente la propria alimentazione sulla batteria interna qualora manchi tensione dalla rete.

Per evitare che le batterie si scarichino quando il contatore non viene utilizzato, usare sempre l'interruttore per spegnere il contatore e non la spina di rete.

Tempo di ricarica (tipico a 20°C): 10 ore al 90% della piena capacità, 5 ore al 70%.

4.3. Immagazzinaggio

Evitare l'immagazzinaggio di batterie totalmente scaricate. Quando il contatore non viene utilizzato, commutare in posizione "OFF" ma mantenere lo strumento collegato alla rete. La batteria rimarrà allora caricata e sempre pronta all'uso. Se l'apparecchio non può essere collegato alla rete o se l'alimentatore a batterie è immagazzinato al di fuori dello strumento, si raccomanda di ricaricarlo per 5 o 10 ore ogni 3 mesi.

Se le batterie devono essere tenute a magazzino per lunghi periodi, togliere il fusibile e immagazzinare l'alimentatore in luogo fresco e secco.

ATTENZIONE

Lunghi periodi di immagazzinaggio o di uso a temperature elevate compromettono la durata della batteria.

L'immagazzinaggio prolungato e il funzionamento a temperature superiori ai 40°C cosi come la carica a temperature superiori ai 35°C dovrebbero essere evitati.

In caso di immagazzinaggio a temperature inferiori ai −40°C, la batteria deve essere caricata almeno al 75% della piena capacità. Le altre condizioni ambientali sono uguali a quelle valide per lo strumento.

Peso addizionale per l'alimentatore a batterie: 0,75 Kg.

Fusibile: 1,6A ad azione rapida.

5. Batteria esterna

Una batteria esterna a 12 V può essere utilizzata come alimentazione per il contatore. Sostituisce nel retro dello strumento il connettore BNC con un innesto a jack per batterie come illustrato alla sezione 7.5 di questo manuale.

NOTA

Il jack per batteria e relativa spina può essere ordinata gratuitamente alla:

Philips Elektronikindustrier AB
Div. I Supply Center Service
S-175 88 JÄRFÄLLA
SVEZIA

Vogliate indicare il numero di tipo e serie dello strumento in causa.

6. Norme di sicurezza

(Secondo IEC 348)

Prima di collegare lo strumento alla rete, verificare visualmente i comandi, connettori ecc. per accertarsi dell'assenza di qualunque danno che avrebbe potuto prodursi durante il trasporto.

Se si riscontrassero diffetti evidenti, non collegare lo strumento alla rete.

Prima di qualunque manutenzione o riparazione lo strumento deve essere scollegato da ogni fonte di tensione ed ogni punto ad alta tensione deve essere scaricato.

Regolazioni e manutenzioni dello strumento in funzionamento con il coperchio rimosso, possono essere eseguite soltanto da tecnici specializzati che conoscano i pericoli che esistono.

NOTA

Tutte le componenti che si trovano al primario del trasformatore sono a norme CSA ed all'occorrenza devono essere usati soltanto ricambi originali.

7. Installazione

7.1. Collegamento rete

Prima di collegare lo strumento alla rete, assicurarsi che sia predisposto per la tensione di rete locale. Alla consegna, l'apparecchio è predisposto per 115V o 230V ± 15%, secondo quanto indicato sul retro dello strumento. Se occorre cambiare la tensione, rivolgersi all'organizzazione di Servizio locale. Il Manuale di Servizio contiene le istruzioni per il cambia tensione.

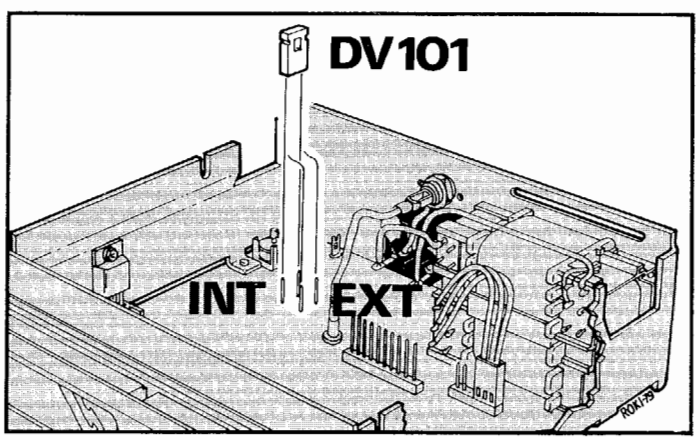
7.2. Messa a terra

L'apparecchio è messo a terra attraverso il cordone di alimentazione a tre conduttori inserito in una presa con contatto di terra protetto. Non viene autorizzato nessun altro modo di messa a terra.

7.3. Standard interno ed esterno

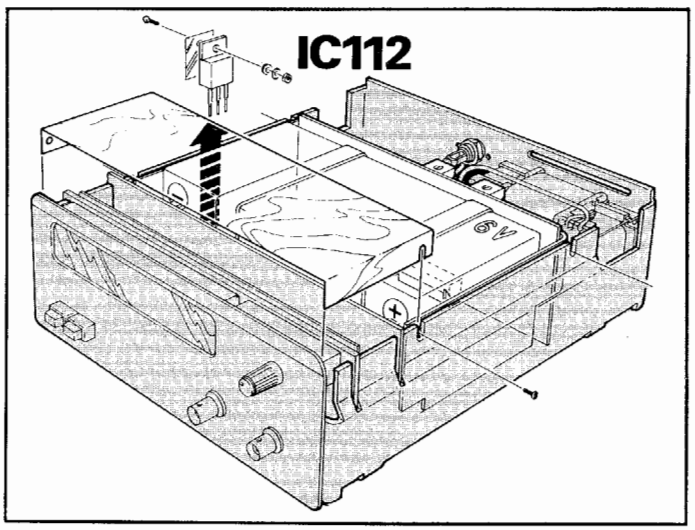
Il contatore può essere impostato sullo standard interno od esterno inserendo il connettore DV 101 come indica la figura in basso.

All' atto della consegna, il contatore è impostato per lo standard interno.



7.4. Alimentatore a batteria PM 9601

- Togliere il cofano del contatore.
- Togliere la piastra superiore di schermaggio.
- Levare il regolatore 5V IC 112 (vedi fig. qui sotto).
- Inserire l'alimentatore a batteria come qui sotto. Tenere i fili dalla batteria alla piastra stampata lungo i lati della batteria.
- Montare la nuova piastra di schermaggio come da fig. qui sotto e fissarla ai lati del contatore per mezzo di due viti.
- Fissare l'alimentatore per mezzo delle viti ai lati del contatore.



7.5. Jack per batteria esterna

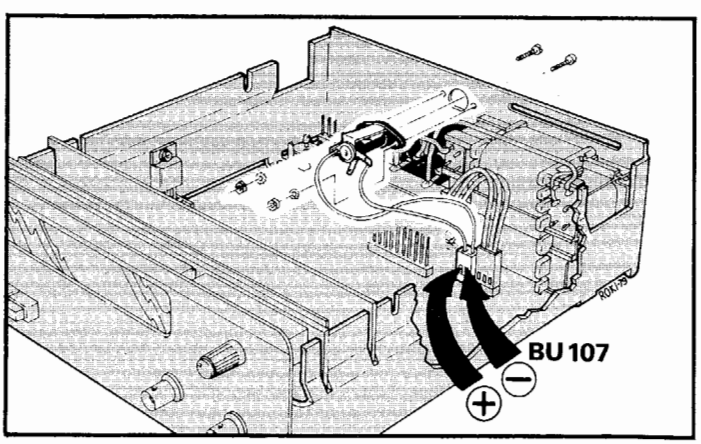
Il contatore BNC sul retro, che serve per lo standard esterno potrà essere sostituito da una presa a jack per alimentazione da batteria esterna.

Procedere come segue per la sostituzione del BNC con il jack per batteria:

- staccare il cavo coassiale dalla piastra stampata e dissaldare il conduttore centrale del BNC.
- sostituire il BNC con il jack per batteria e collegare il conduttore in modo che coincida con la polarità della presa batteria.

Vedi qui sotto.

La spina doppia (BU 107) è protetta con diodi per evitare danni in caso di inversione della polarità di batteria.



8. Comandi e connettori

POWER ON

Serve per accendere o spegnere lo strumento. ATTENZIONE si tratta di un commutatore sul secondario, e quindi anche in posizione "POWER OFF" all'interno dello strumento vi sono punti sotto tensione e componenti cariche. Per togliere completamente tensione si deve staccare il cavo di alimentazione dalla rete.

In caso di mancanza di tensione di rete, il contatore è automaticamente commutato su alimentazione da batteria.

MEASUREMENT RATE

Serve per variare la cadenza della misura: NORMAL oppure FAST. In NORMAL si esegue 1 misura al secondo, in FAST 5 misure al secondo, ridotte automaticamente per frequenze molto basse sino ad 1 misura al secondo per 10 Hz.

SENSITIVITY

Regola in 6 passi la sensibilità d'ingresso da 15mV$_{eff}$ à 5 V$_{eff}$.

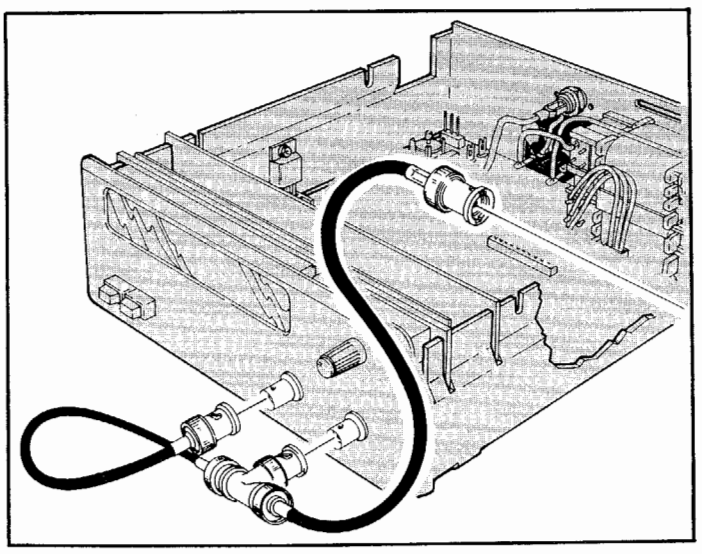
NOTA: Per ridurre l'influenza di disturbi e interferenze non posizionare mai su sensibilità superiori a quella necessaria.

Ingresso RF solo sul PM 6668

Ingresso accoppiato in AC a bassa impedenza (50 ohm) per segnali a frequenze da 70 MHz a 1 GHZ.

Il microprocessore del contatore rivela la presenza di un segnale RF e sceglie automaticamente questo ingresso appena che la frequenza di entrata è sufficientemente alta per la misura. Questo rende possibile il collegamento simultaneo, mediante un raccordo a T, dello stesso segnale alle due entrate. (Vedi figura qui sotto.) Il contatore commuterà automaticamente sull'uno o sull'altro dei due ingressi nel momento in cui la frequenza di un segnale cambia; per esempio nel caso di una frequenza spazzolata.

Più informazioni sul segnale in ingresso sono date nella sezione 2, Specifica Tecnica.



Ingresso Bassa Frequenza

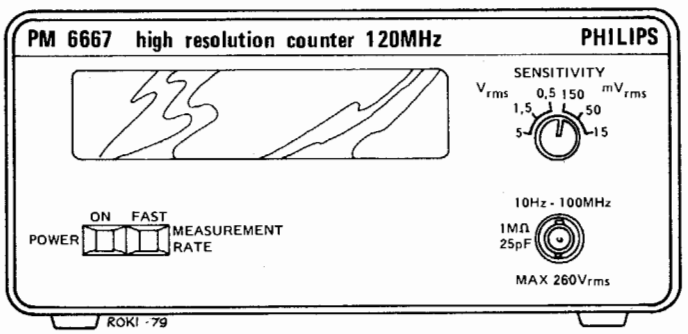
Ingresso accoppiato in AC ad alta impedenza (1 Mohm) per segnali a frequenze da 10 Hz a 120 MHz. Un circuito autotrigger automaticamente assicura un triggering corretto per ogni tipo di segnale sia impulsivo sia sinusoidale con qualsiasi ciclo di carico.

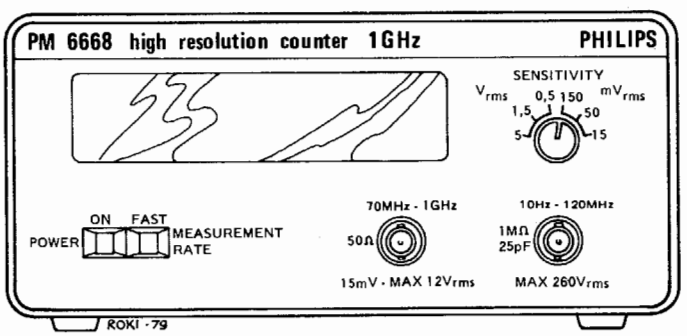
STANDARD ESTERNO O BATTERIA

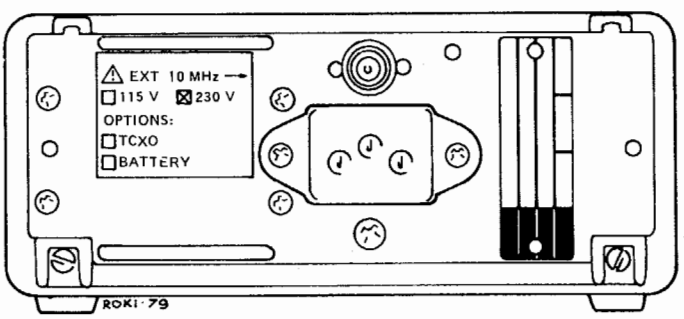
Ingresso BNC per lo standard esterno o a scelta, come accessorio opzionale, presa a jack per batteria esterna.

Presa tensione rete

Utilizzare sempre il cordone a tre conduttori che viene fornito con il contatore.

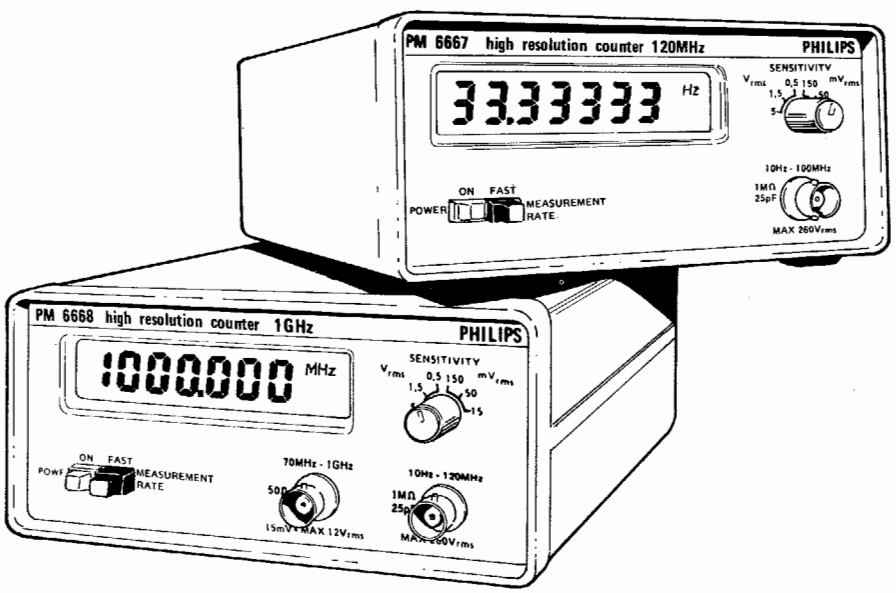






PHILIPS

Gebruiksaanwijzing



1. Inleiding

De PM 6667 en de PM 6668 zijn frequentiemeters die uitgerust zijn met een microcomputer en een meetbereik hebben van 10 Hz ... 120 MHz (PM 6667) en 10 Hz ... 1 GHz (PM 6668).

De toepassing van de microcomputer maakt een nieuwe aanpak van frequentiemetingen mogelijk waarbij de traditionele fout van ±1 periode wordt vermeden. Door het uitvoeren van een meervoudige periode meting en het berekenen van de reciproke waarde daar van, kunnen met deze teller lage frequenties worden gemeten met zeer grote resolutie. Een ander voordeel van de microcomputer in deze tellers is de automatische keuze van het meetgebied.

Het meetresultaat wordt altijd weergegeven met maximale resolutie zonder overschrijding van het meetbereik en met de juiste aanduiding van Hz, kHz, MHz en komma.

Men kan kiezen tussen twee meetsnelheden: NORMAL d.w.z. 7 cijfers per seconde of FAST d.w.z. 6 of 7 cijfers per 200 ms. De snelle manier wordt toegepast voor het meten van wisselende frequenties, zoals bij het afregelen van circuits.

Verder zijn nog de volgende opties beschikbaar: een model met stabielere tijdsbasis TCXO (/02 versie) met oplaadbare accu PM 9601, die aan de binnenkant van de teller kan worden aangebracht, een stootvast (ABS) draagkoffertje PM 9602 en een adaptor PM 9603 voor montage in een 19" rack of paneel.

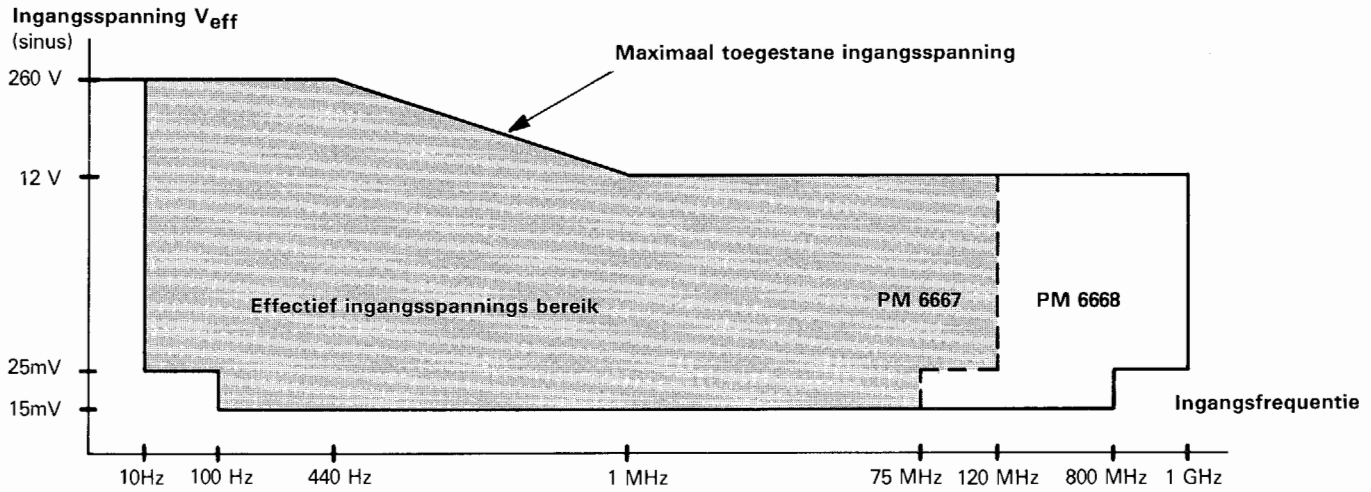
De 7-cijferige vloeibare kristallen display (LCD) bevat eveneens indicators voor eenheden en komma.

Nadat de teller is ingeschakeld, voert deze zelf een controle uit. Ingeval er ergens een fout is ontdekt, wordt deze door een diagnostische code aangeduid.

WAARSCHUWING:

Voordat de teller op de netspanning wordt aangesloten, dient men eerst de veiligheidsvoorschriften op bladzijde 35 te lezen.

2. Technische specificaties



Frequentiebereik

PM 6667: 10Hz ... 120MHz
PM 6668: 10Hz ... 1GHz

Ingangsgevoeligheid
(in $15mV_{eff}$ positie)

LF-ingang: $15mV_{eff}$ sinus;
100Hz ... 75MHz

$25mV_{eff}$ sinus;
10Hz ... 120MHz

$45mV_{p-p}$ voor impulsen met een impulsduur van ⩾ 7 ns

RF-ingang: (alleen PM 6668)

$15mV_{eff}$ sinus;
70MHz ... 800MHz

$25mV_{eff}$ sinus;
800MHz ... 1GHz

(zie ingangsspannings diagram)

Ingangsdemping

LF-ingang: x 1 tot x 300 in 6 standen
RF-ingang: automatische demping

Trigger niveau

Een vaste spanning (+ , 0 of —) wordt automatisch toegevoerd voor het juiste triggeren op elke signaalvorm en werkcyclus.

Maximaal toegestane ingangsspanning (zonder beschadiging)

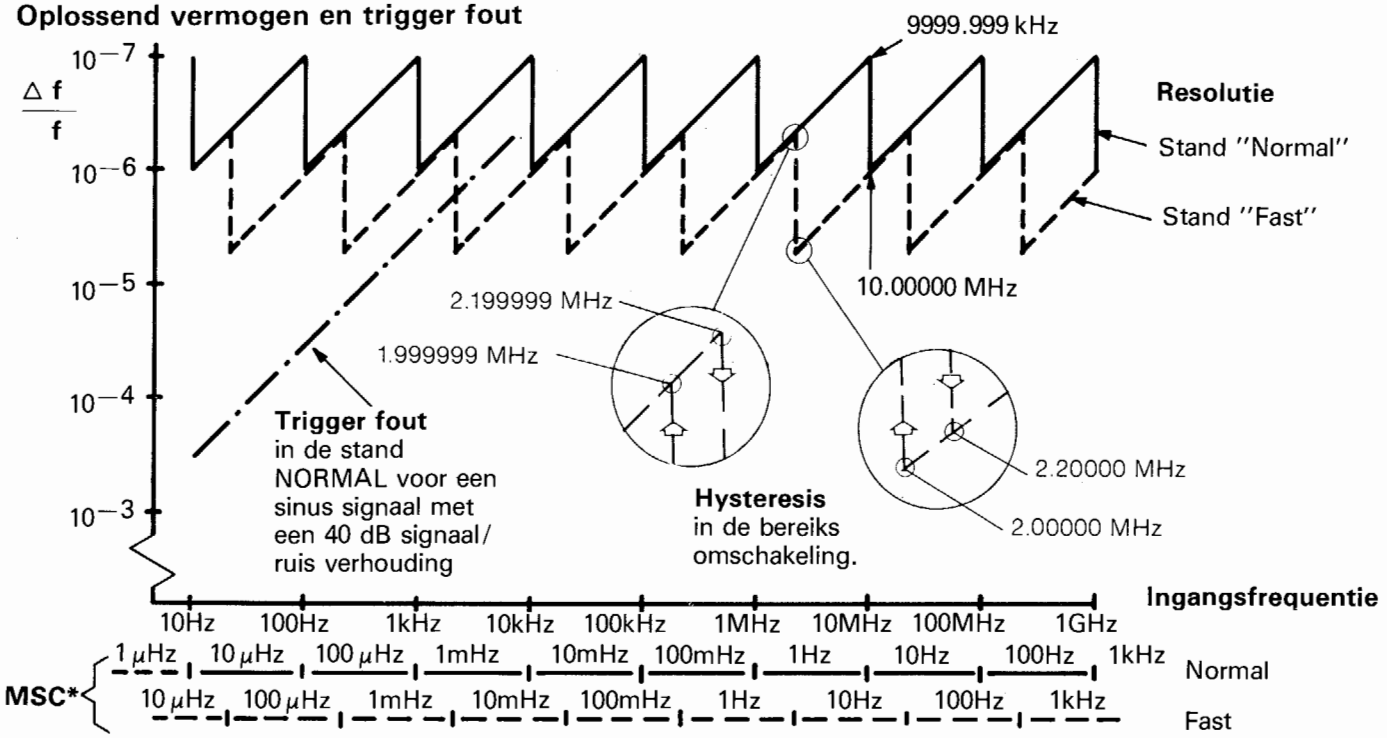
Gelijkspanning: 300V
Wisselspanning: $260V_{eff}$ bij ⩽ 440Hz, afnemend tot $12V_{eff}$ bij 1 MHz (zie bovenstaande eigenschappen betr. ingangsspanning)

Koppeling: wisselspannings gekoppeld.

Ingangsimpedantie

LF-ingang: 1MΩ//≈ 25pF
RF-ingang: 50Ω nominaal met staande golf verhouding < 2 (alleen voor de PM 6668)

Oplossend vermogen en trigger fout



Meetsnelheid

Normal (Normaal), (uit): ongeveer 1 meting/seconde
Fast (Snel), (in): ongeveer 5 metingen/seconde. Bij frequenties onder 100 Hz, neemt de meetsnelheid geleidelijk af tot één meting per seconde om de invloed van de trigger fout te beperken.

Display

7 cijfers, 11,5 mm, vloeibare kristallen display met aanduiding Hz, kHz, MHz en LO BAT (lege accu).

Onnauwkeurigheid (relatieve frequentie fout)

$$\pm \frac{\text{MSC*}}{\text{ingangsfrequentie}} \pm \text{Rel. trigger fout}$$

± tijdbasis fout

Rel. trigger fout:

Voor iedere signaalvorm:

$$\frac{\text{meetsnelheid}}{\text{helling v.h. signaal (V/s)}}$$

x piek tot piek ruisspanning

Voor sinus signalen

$$\frac{\text{meetsnelheid}}{\text{ingangsfrequentie} \times \pi \times \text{signaal/ruis verhouding}}$$

* minst significante cijfer.

Voorbeeld: Bij een signaal/ruis verhouding van 100 (40dB) en een gekozen snelheid van 1 meting/sec. bedraagt de triggerfout:

$$\frac{3 \times 10^{-3}}{\text{ingangsfrequentie}}$$

Oplossend vermogen

Wat het minst significante cijfer (MSC) en het oplossend vermogen betreft, zie bovenstaande grafiek.

Externe referentie ingang

Frequentie:	10 MHz
Ingangsspanning bereik:	$0{,}5V_{eff} \ldots 12V_{eff}$
Ingangsimpedantie:	ongeveer 2kΩ

Voedings spanning

115/230V, ±15%, 50 ... 60Hz; 15VA of de ingebouwde accu (accessoire) PM 9601 of een externe 12 V gelijkspanning.

Veiligheid

Overeenkomstig IEC 348 en CSA 566 B.

Netstoring

Lager dan klasse II CENELEC/CISPR.

Afmetingen en gewicht

Breedte: 160 mm
Hoogte: 77 mm
Lengte: 180 mm
Gewicht: 1,2 kg

Omgevingscondities

Temperatuur:

Opslag:	−40°C ... +70°C
Werking:	0°C ... +45°C

Hoogte/barometer druk:

Opslag: 15000 m/15,2 kN/m²
Werking: 5000 m/53,3 kN/m²

Vochtigheid:

10% ... 90% relatieve vochtigheid (dauwpunt 26°C)

Trillingsproef:	voldoet aan IEC 68 Fc
Stootproef:	voldoet aan IEC 68 Eb
Hanteringsproef:	voldoet aan IEC 68 Ec
Transportproef:	voldoet aan NLN-L88

Tijdbasis eigenschappen

Tijdbasis versii	/01 (standaard)	/02 (TCXO)
X-tal frequentie	10MHz	10MHz
Oudering	$\leqslant 5 \times 10^{-7}$/maand	$\leqslant 1 \times 10^{-7}$/maand
Temperatuurbestendigheid		
0...50°C, cal, temp +25°C	$\leqslant 1 \times 10^{-5}$	$\leqslant 1 \times 10^{-6}$
20...30°C, cal. temp+25°C	$\leqslant 3 \times 10^{-6}$ (typisch)	$\leqslant 3 \times 10^{-7}$ (typisch)

3. Accessoires

3.1. Standaard accessoires (meegeleverd met het apparaat)

— Netsnoer
— Instruktiehandboek

3.2. Opties
(afzonderlijk te bestellen)

— PM 9601 oplaadbare accu-eenheid
— PM 9602 draagkoffertje
— PM 9603 hulpstuk voor montage in 19" rek of paneel
— PM 9665 B 50 kHz laagdoorlaat filter, BNC—BNC
— PM 9236 15 MHz, 10 Mohm verzwakkersonde
— PM 8935 250 MHz, 10 Mohm verzwakkersonde
— Batterijsteker (zie par. 5 en 7.5 in dit handboek).

4. Accu-eenheid PM 9601

4.1. Algemene gegevens

De PM 9601 is een oplaadbare accu, die in de tellers PM 6667 en PM 6668 gemonteerd kan worden. De eenheid bevat een gasdichte 6 V batterij van het lood-zuurgelei type. Verder bevat deze het laadcircuit alsmede een beveiliging tegen overbelasting.

De accu-eenheid wordt met vier schroeven in het metalen binnenframe van de kast gemonteerd (zie installatievoorschriften).

Het is een standaard accu, die bij diverse accufabrikanten verkrijgbaar is. Voor reserveaccu's neemt U rechtstreeks contact op met Uw acculeverancier, die nieuwe opgeladen accu's in voorraad heeft.

Fabrikant	Land van herkomst	Type	Capaciteit
Sonnenschein*	West Duitsland	3GX3S	3 Ah
Varta*	West Duitsland	Accu Pb 30704063	3 Ah
Gold Gelyte	Verenigde Staten	Pb 626-1	2.6 Ah
Elpower	Verenigde Staten	Ep 626A-6	2.6 Ah
SAFT*	Frankrijk	PA 601	4 Ah
Kono	Japan	6-26k	2.6 Ah

* aanbevolen merk

WAARSCHUWING

De capaciteit van oplaadbare accu's neemt af als de accu's niet worden gebruikt of niet herhaaldelijk worden opgeladen. Lees daarom nauwkeurig de aanwijzingen voor opslag.

4.2. Opladen

De accu wordt automatisch opgeladen zodra de teller op de netspanning wordt aangesloten, en de schakelaar in de OFF-stand staat.

Als 'LO BAT' oplicht, dan werkt de accu nog ongeveer 15 minuten voordat deze opnieuw moet worden opgeladen.

De teller schakelt automatisch over op de interne accuvoeding als de netspanning uitvalt.

Om ongewenste ontlading van de batterijen te voorkomen als de teller niet wordt gebruikt, moet men altijd de aan/uit schakelaar (en niet het netsnoer) gebruiken om de teller uit te schakelen.

De oplaadtijd bedraagt bij 20°C: 10 uur tot 90% van de volledige capaciteit, 5 uur tot 70% van de volledige capaciteit.

4.3. Opslag

Vermijd de opslag van lege accu's.

Als het apparaat niet in gebruik is zet dan de schakelaar in de OFF-stand, maar houd het wel op de netspanning aangesloten. De batterij blijft dan opgeladen en is altijd klaar voor gebruik. Als het apparaat niet op de netspanning kan worden aangesloten of als de batterijen buiten het apparaat zijn opgeslagen, dan is het aan te bevelen om de batterijen om de drie maanden gedurende 5 tot 10 uren op te laden.

Als het apparaat langer opgeslagen moet blijven, verwijder dan de zekering uit de batterijhouder en bewaar de batterij koel en droog.

WAARSCHUWING

Permanent gebruik en opslag bij hoge temperatuur heeft een negatieve invloed op de levensduur van de accu.

Langdurige opslag en gebruik boven +40°C alsmede opladen boven +35°C moet vermeden worden. Voor opslag bij —40°C moet de accu tot minstens 75% van de totale capaciteit worden opgeladen.

De overige omgevingsvoorwaarden zijn dezelfde als voor de teller.

Bijkomend gewicht voor batterijeenheid: 0,75 kg.

Zekering: 1,6 A snel.

5. Externe Batterij

Een externe 12 V batterij kan men gebruiken als krachtbron voor de teller. Vervang de BNC-aansluiting aan de achterkant door een batterijbus, zoals beschreven in par. 7.5. van dit handboek.

OPMERKING

De batterijbus met plug is kosteloos verkrijgbaar bij:

Philips Elektronikindustrier AB
Div. I. Supply Center
S-175 88 Järfälla Sweden

Geef daarbij het typenummer en het volgnummer van uw apparaat aan.

6. Veiligheidsvoorschriften

(in overeenstemming met IEC 348)

Voordat men het apparaat op de netspanning aansluit, moet men de kast, regelorganen, aansluitingen, enz. controleren, om er zeker van te zijn dat zich tijdens vervoer geen beschadigingen hebben voorgedaan. Als blijkt dat er gebreken zijn, sluit het apparaat dan niet op het net aan. Het apparaat moet van alle spanningsbronnen losgekoppeld worden, voordat reparatie- of onderhoudswerkzaamheden worden uitgevoerd.

Reparaties of onderhoudswerkzaamheden te verrichten terwijl het apparaat in werking is en de kappen eraf zijn, mogen alleen verricht worden door ervaren personen die zich bewust zijn van de daaraan verbonden gevaren.

OPMERKING
Alle onderdelen aan de primaire zijde van de transformator zijn CSA goedgekeurd en mogen slechts door orginele onderdelen vervangen worden.

7. Installatie

7.1. Aansluiting op het net

Voordat men het apparaat op het net aansluit, moet men controleren of het op de juiste plaatselijke netspanning is ingesteld. Bij aflevering wordt het apparaat afhankelijk van bestemming op 115V of 230V ±15% afgesteld, hetgeen achter op het apparaat staat aangegeven. Als het apparaat op een andere spanning moet worden afgesteld dan staat aangegeven, moet U contact opnemen met Uw plaatselijke serviceorganisatie. In het servicehandboek staan de afstelvoorschriften.

7.2. Aarding

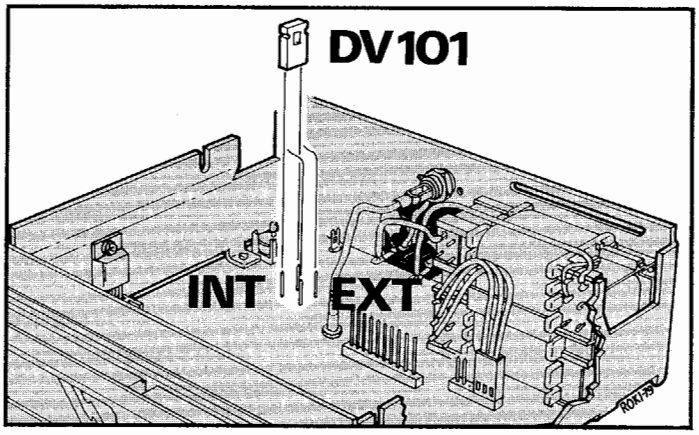
Het apparaat wordt geaard via het drieaderig netspanningsnoer dat in een geaard stopcontact wordt gestoken.

Een andere manier van aarden is niet toegestaan.

7.3. Interne en externe tijdstandaard

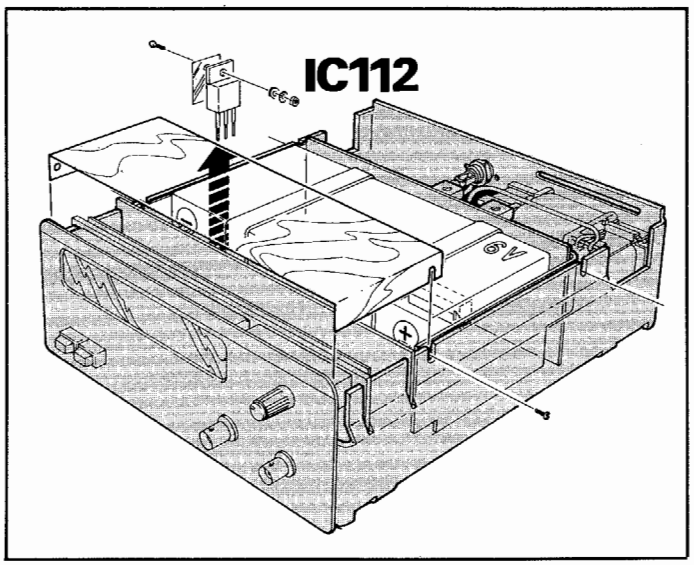
De teller kan men instellen op externe of interne standaard door brugverbinding DV 101 aan te brengen als aangegeven in de onderstaande figuur.

Bij aflevering wordt de teller op de interne standaard afgesteld.



7.4. Interne batterijeenheid PM 9601

- Verwijder het tellerhuis.
- Verwijder de bovenste afschermplaat.
- Verwijder de +5V regelaar IC 112 (zie onderstaande figuur).
- Plaats batterijeenheid zoals aangegeven in onderstaande figuur. Leg de draden van de batterij naar de printplaat langs de zijkanten van de batterij.
- Bevestig de nieuwe afschermplaat zoals aangegeven in onderstaande figuur, en zet deze met twee schroeven aan de zijwanden van de teller vast.
- Schroef de houder tegen de zijwanden van de teller.



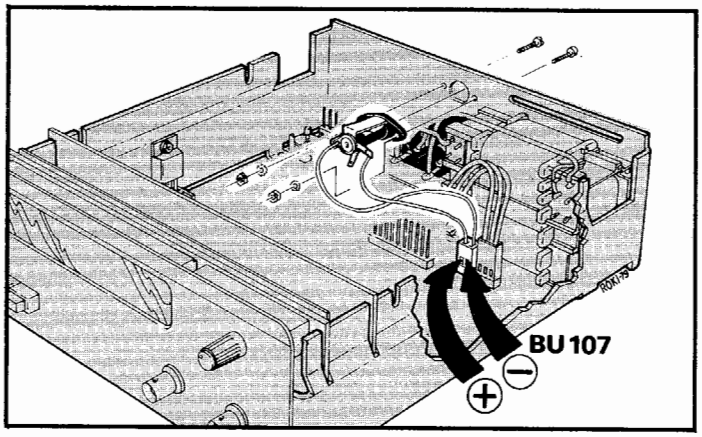
7.5. Externe stekerbus voor batterij

De BNC-bus aan de achterkant van de externe standaard kan men vervangen door een bus voor externe batterijvoeding. De bus komt overeen met DIN 45323.

Ga bij het vervangen van de BNC-bus door de bus voor batterijvoeding als volgt te werk:

- Maak de coaxkabel los van de printplaat en soldeer de centrale verbinding van de BNC-bus los.
- Vervang de BNC-bus door de batterijbus en sluit de tweepolige bus zodanig aan dat deze overeenkomt met de polariteit van Uw batterijplug. Zie onderstaande figuur.

De tweepensaansluiting (p/o BU 107) wordt met een diode beschermd om schade te voorkomen als de inganspolariteit wordt verwisseld.



8. Regelingen en aansluitingen

Inschakelen

Schakel de teller in/uit. VOORZICHTIG: Dit is een secundaire schakelaar. Zelfs in de POWER-OFF stand, bevat de teller spanning voerende delen. Het netsnoer moet verwijderd worden om de teller volledig uit te schakelen.

Als de netspanning uitvalt, schakelt de teller automatisch op batterijvoeding over.

Meetsnelheid

Stel de meetsnelheid in op een van de twee snelheden. NORMAL (niet ingedrukt) of FAST (ingedrukt).

NORMAL (normaal) houdt in: ongeveer één meting per seconde en FAST (snel) ongeveer 5 metingen per seconde. De meetsnelheid in de snelstand wordt bij lagere frequenties tot ongeveer één meting per seconde bij 10 Hz teruggebracht.

Gevoeligheid

Stel de ingangsgevoeligheid in met keuze uit zes bereiken van 15 mV_{eff} tot 5 V_{eff}.

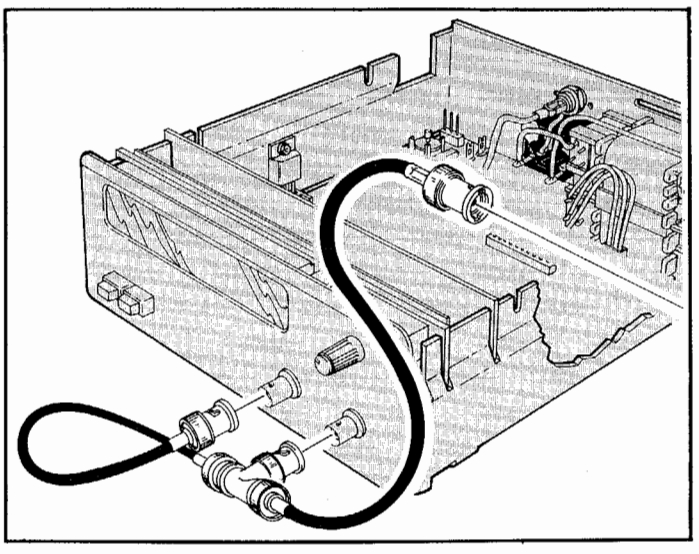
N.B.: Om de invloed van ruis en storingen te verminderen, dient u nooit een hogere gevoeligheid te kiezen dan strikt noodzakelijk is.

RF-ingang (alleen PM 6668)

Een laagohmige (50 ohm), wisselspannings gekoppelde ingang voor sinussignalen met frequenties van 70 MHz tot 1 GHz.

De microcomputer van de teller signaleert de aanwezigheid van een RF-signaal en kiest deze ingang automatisch. Indien geen RF signal gesignaleerd wordt, wordt met het LF kanaal gemeten. Hierdoor kan men hetzelfde signaal aan beide ingangen aansluiten met een T-verbinding. Zie onderstaande figuur.

De teller schakelt dan automatisch tussen de twee ingangen als de signaalfrequentie verandert, bijvoorbeeld als er een frequentiezwaai gemeten wordt. Meer gegevens over het ingangssignaal worden in de technische specificaties gegeven.



LF-ingang

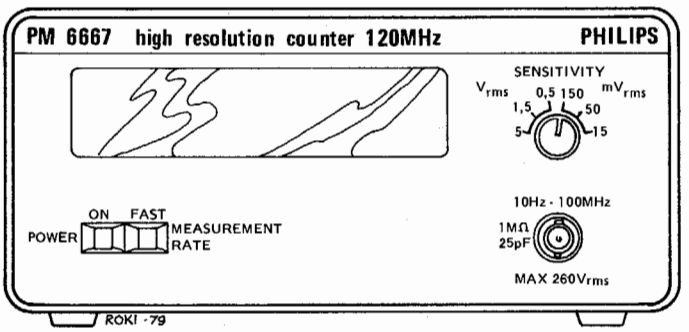
Een hoogohmige (1 Mohm), wisselspannings gekoppelde ingang voor signalen met frequenties van 10 Hz tot 120 MHz. Een **auto-trigger circuit** zorgt ervoor dat op alle signaal vormen (zowel sinus als smalle pulsen) op de juiste wijze getriggerd wordt.

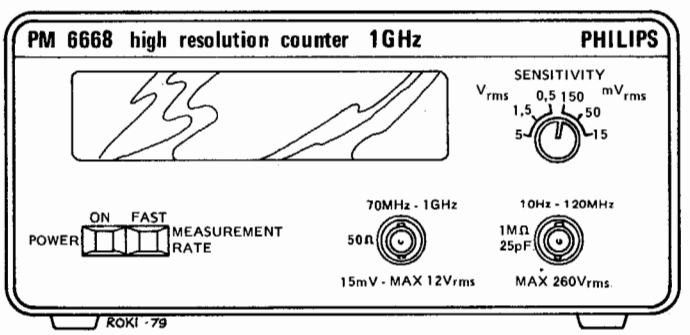
EXTERNE STANDAARD of BATTERIJ

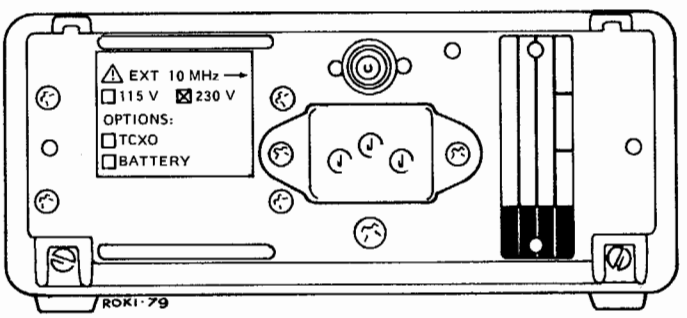
BNC-ingang voor externe tijdbasisstandaard, of, als extra, batterijbus voor externe batterij.

Netspanningsaansluiting

Ingang voor netspanning. Gebruik altijd het drieaderig netsnoer dat met de teller meegeleverd word.







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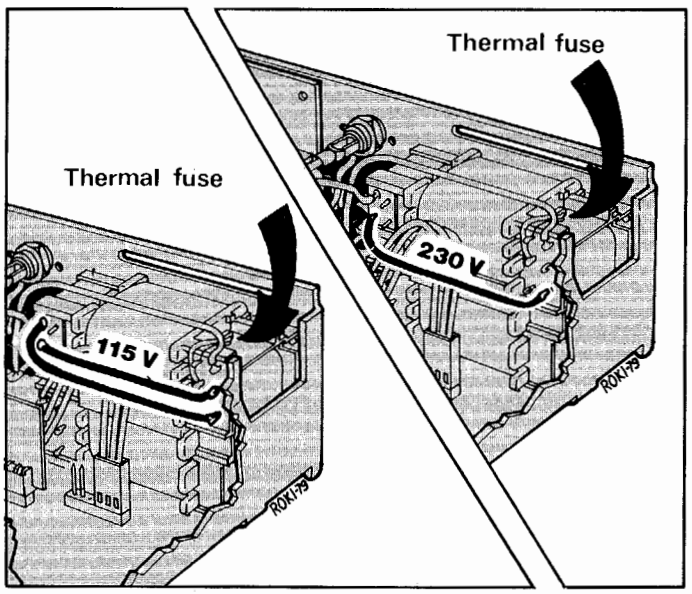
Service part

9. Line voltage setting

The instrument can be set to 115 V or 230 V. On delivery, the instrument is set to the line voltage as indicated at the rear of the instrument.

The instrument is protected by a thermal fuse located in the line transformer.



10. Technical description

10.1. Principles of the computing reciprocal counter

Fig 10.1 and 10.2 illustrate the difference between a conventional counter and a computing reciprocal counter.

In the conventional counter the input cycles are totalized in the decimal counting unit during a well defined time, the gate time e.g. 1 s or 0.1 s.

With a high frequency at input, more counts are accumulated than with a low frequency and hence the realtive resolution will increase with increased frequency.

The computing reciprocal counter, however, has two counting registers, one totalizing the number of input cycles (Event counter) and the other one (Time counter) totalizes, during the same time, the number of 10 MHz cycles from the reference oscillator.

The correct frequency is then computed by the microcomputer (μC) as $f_{displayed} = \frac{\text{Event counts}}{\text{Time counts} \times 10^{-7}}$

The resolution is depending on the 10 MHz clock frequency together with the measuring time, and in PM 6667 and PM 6668 this means a resolution of ±1 Hz in 10 MHz (i.e. a relative resolution of 10^{-7}) with measurement rate in normal mode (1 s measuring time).

Conventional frequency counter

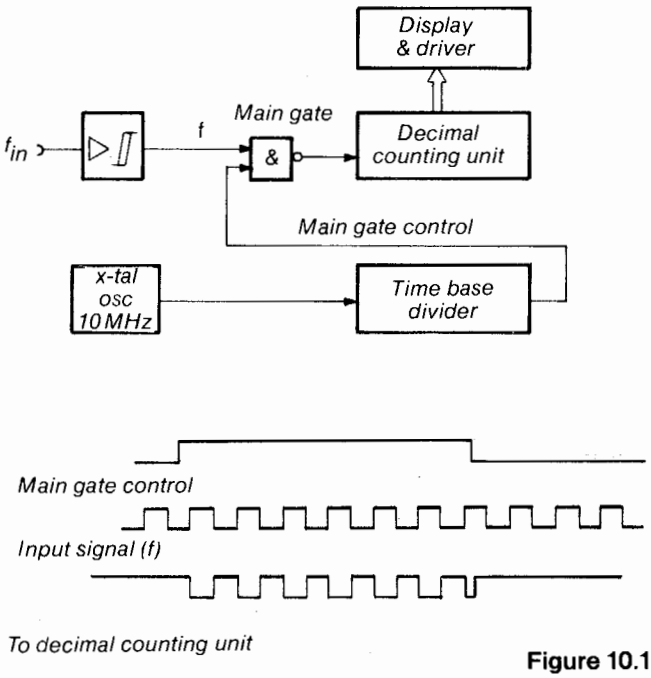


Figure 10.1.

Computing reciprocal counter

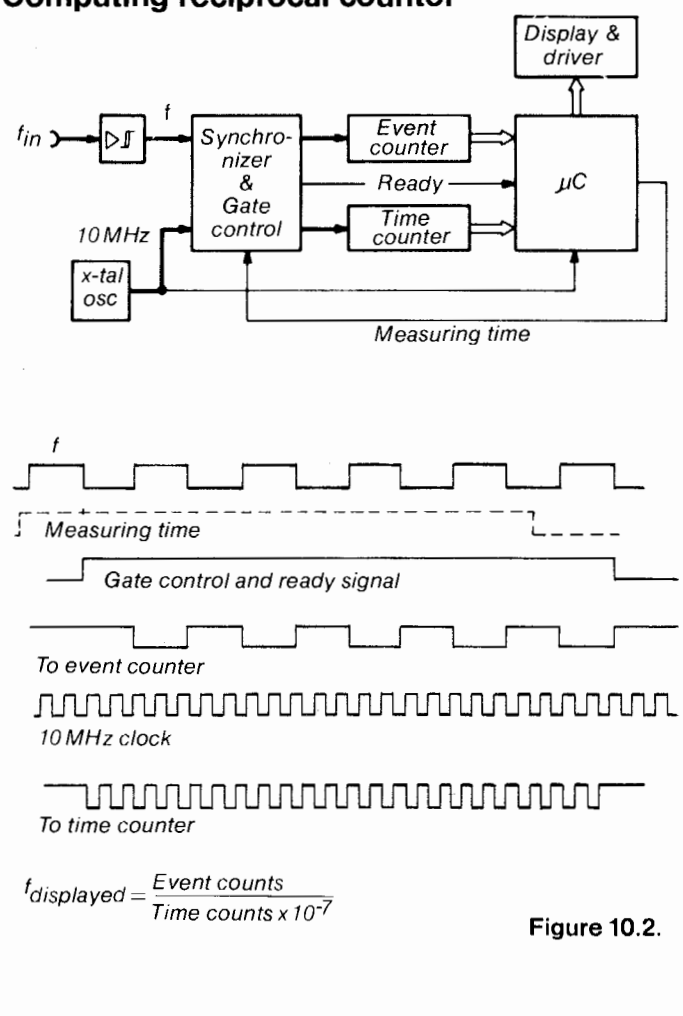


Figure 10.2.

The resolution is hence not affected by the fact that the input signal is prescaled before being gated in the main gate.

The traditional ±one count error will be only one cycle of the 10 MHz reference frequency since the signal to be measured is controlling the main gate (just like in a conventional period measurement).

10.2. Block diagram description

See figure 10.3.

In PM 6667 and PM 6668 the LF input frequency is first divided by 10 before the gating takes place. In the RF input (PM 6668 only) the division factor is 256.

This, however, does not influence the measurement resolution of $\frac{10^{-7}}{\text{measuring time (s)}}$

These dividers are actually parts of the period averaging and are compensated for by the µC.

The LF input circuit contains a traditional FET input circuit and a 6-position step attenuator. Next, a special patented AUTO TRIGGER circuit takes care of all possible duty factors and polarities. The AUTO TRIGGER circuit automatically offsets the trigger circuit to compensate for the DC offset caused by variations in the duty factor of the input signal. The principle of function of the AUTO TRIGGER circuit is illustrated in figures 10.4.

Two Schmitt triggers "A" and "B" (fig. 10.4) are used in the trigger circuit. "A' has a zero-offset hysteresis band. "B" has two locations of the hysteresis band, B_{HI} and B_{LO}. The offset of the hysteresis band (B_{HI} or B_{LO}) is controlled by the output state of Schmitt trigger A.

Assuming that the hystereses offset is B_{LO} and the input signal intersects point (1), the output of trigger "A" goes high. This makes that the hysteresis band will be offset to position B_{HI}. The subsequent pulses will then trigger the Schmitt trigger B correctly at points (2), (3) and (4) etc.

The first pulse in the pulse train is, as we see, used to correct the offset of Schmitt trigger B if that is necessary due to a wrong position of the offset in the initial state.

At negative polarity of the input signal the triggering sequence is the same but hysteresis band B_{LO} is now used. At cross-over point (7), trigger "B" will switch over to B_{LO}. The Schmitt trigger B will then trigger at points (8), (9) and (10) etc.

At symmetrical input waveforms the Schmitt triggers will operate as shown in fig. 10.4.

The central part of the counter is the microcomputer (µC). It controls the SYNCHRONIZER & GATE CONTROL by the "measuring time"-signal. When this signal goes high the next input cycle opens the input gates (synchronous with the input signal). After elapsed measuring time the next input cycle will close the input gates (again synchronous with the input signal).

The counting registers incorporated in the µC are used for the main part of the TIME COUNTER. However, the 8-bit counter outside the µC forms the fastest part.

The EVENT COUNTER consists of a 2-bit binary counter followed by two quad decades forming an 8-decade counter.

The driving circuitry for the liquid crystal display (LCD) is based upon a special driving circuit. Three such circuits are used as serial to parallel converters. The display information is transmitted on one line and is then stored in the shift registers of the LCD driver. The driver also contains the necessary oscillator and driver systems to drive the LCD in a proper AC mode.

The LCD contains 7 digits, 11.5 mm high, decimal point and unit indications.

The HF input of the PM 6668 has a PIN diode arrangement to attenuate high amplitudes and to provide also an overload protection. The integrated amplifier (similar to the amplifier at the LF-input) is followed by a detector and the divide-by-256 circuit. The DC output from the detector is fed to a comparator, which generates an output signal "HF disable" to the µC. The µC generates a return signal "LF enable" which is high if no HF signal is present. When the frequency of the HF signal is high enough, the "LF enable" signal goes low, enabling the HF channel. Hence, the HF signal will be counted automatically if it is availavle simultaneously with an LF signal.

Both counter models operate from a single 5 V power supply. An optional built-in battery supply is available.

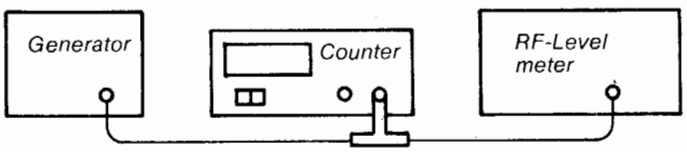
11. Performance check

11.1. Test equipment

- 1 RF-millivoltmeter or a 50 ohm input oscilloscope or any other level meter ranging up to 120 MHz for PM 6667 and to 1 GHz for PM 6668.
- Sinewave generator with a 50 ohm output 10 Hz . . . 120 MHz (PM 6667), 10 Hz . . . 1 GHz (PM 6668).
- 1 BNC T-piece.
- 3 Coaxial cables with 50 ohm impedance.

11.2. Low frequency input

(1 M ohm)

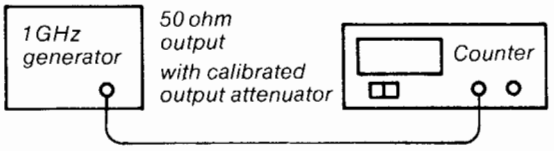


Use as short cables as possible!

- Set the sinewave generator to a voltage of 15 mV_{RMS} and with a sensitivity setting on the counter of 15 mV_{RMS}. Check that counter correctly displays any value in the range 100 Hz . . . 75 MHz.
- Adjust sinewave generator output to 25 mV and check that counter displays correct values at 10 Hz and at 120 MHz.

11.3. High frequency input

(50 ohm, PM 6668 only)



- Set signal generator to a voltage of 15 mV_{RMS} (-24 dB) and check that counter correctly displays any value in the range 70 MHz . . . 800 MHz.
- Set the generator output to 25 mV_{RMS} (-19 dB) and check that counter displays correct value at 1 GHz.

Block diagram PM 6667 and PM 6668

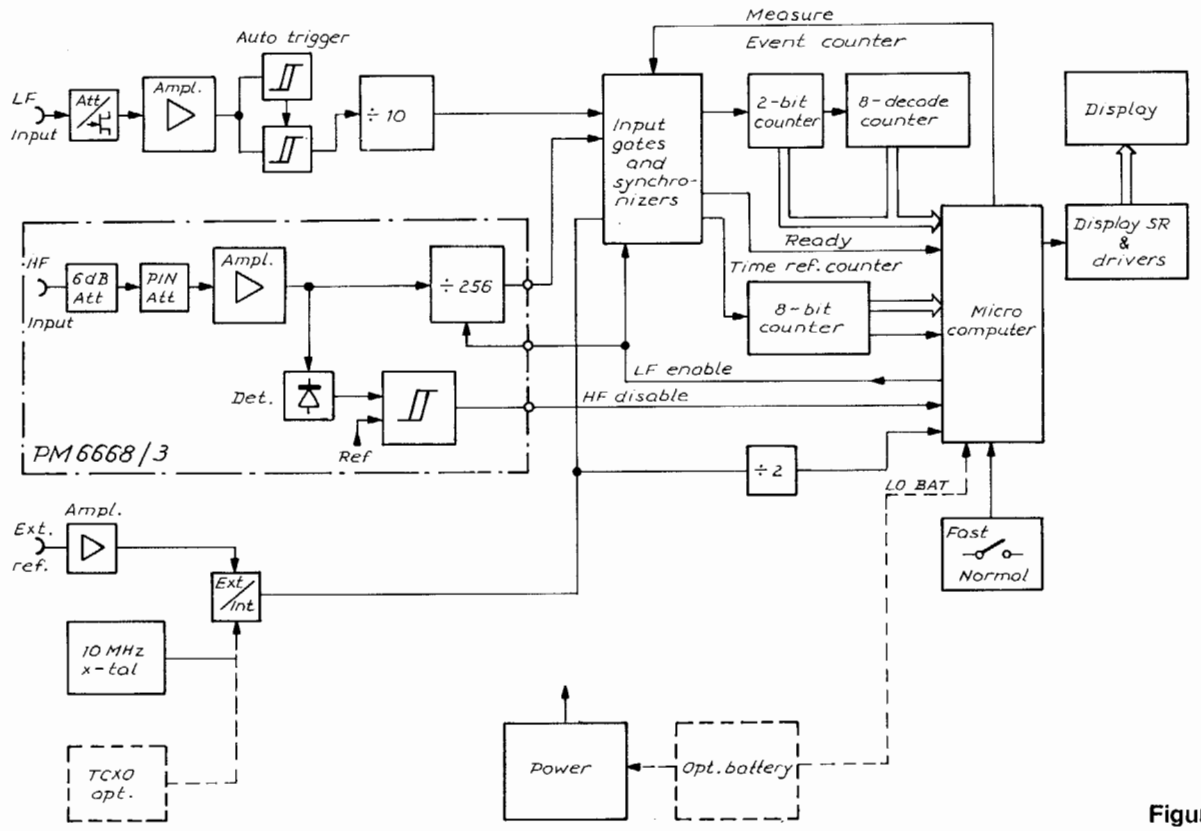


Figure 10.3.

Auto trigger operation

(patented)

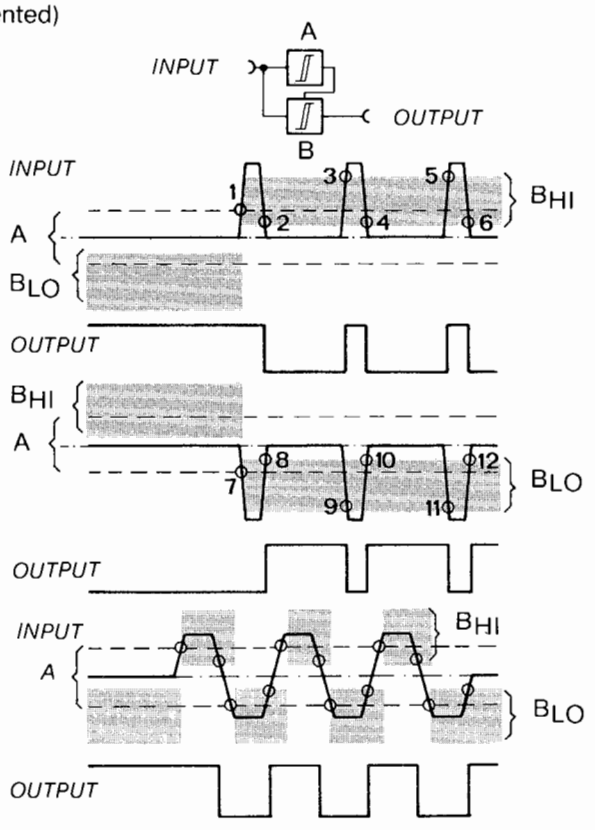


Figure 10.4.

Traditional trigger operation

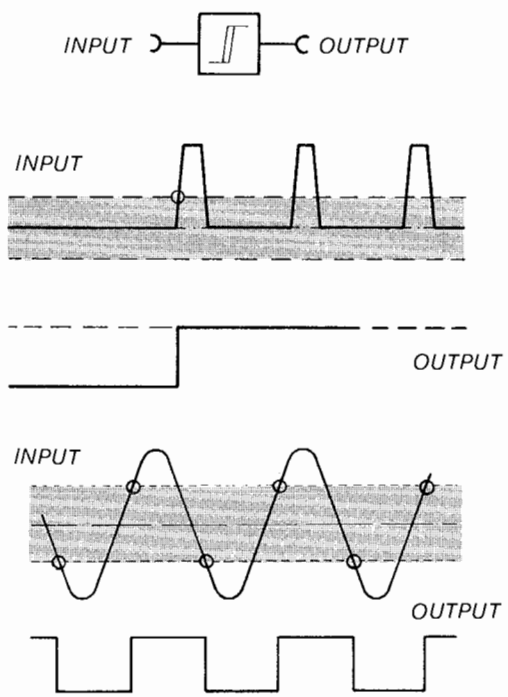


Figure 10.5.

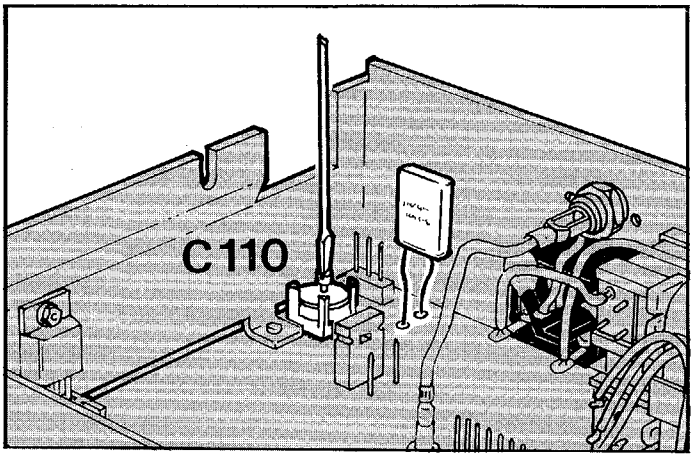
12. Adjustments

12.1. Frequency adjustment of standard oscillator (Models PM 6667/01, PM 6668/01)

Equipment required:
10MHz reference signal, inaccuracy $\leq 1 \times 10^{-6}$

Note: adjustment should preferably be made at an ambient temperature of +25°C (+77°F) after 1h warm up.

— Remove housing.
— Connect reference signal to LF input.
— Adjust C110 to read 10MHz ±10Hz on display.

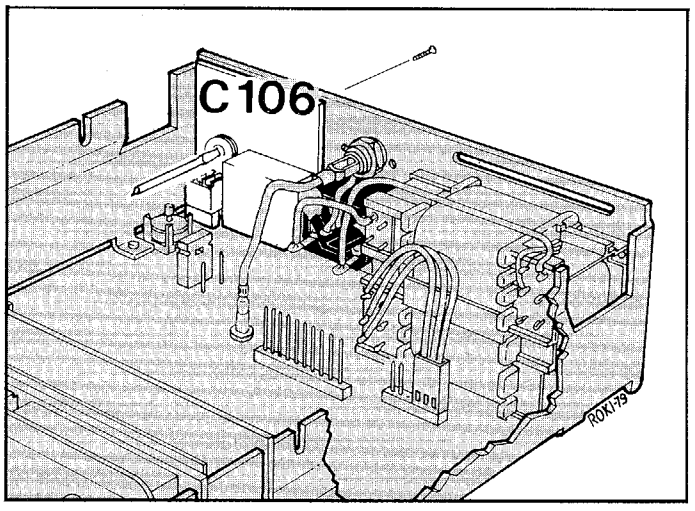


12.2. Frequency adjustment of TCXO
(Models PM 6667/02, PM 6668/02)

Equipment required:
10MHz reference signal, inaccuracy $\leq 1 \times 10^{-7}$.

Note: adjustment should preferably be made at an ambient temperature of +25°C (+77°F) after 1h warm up.

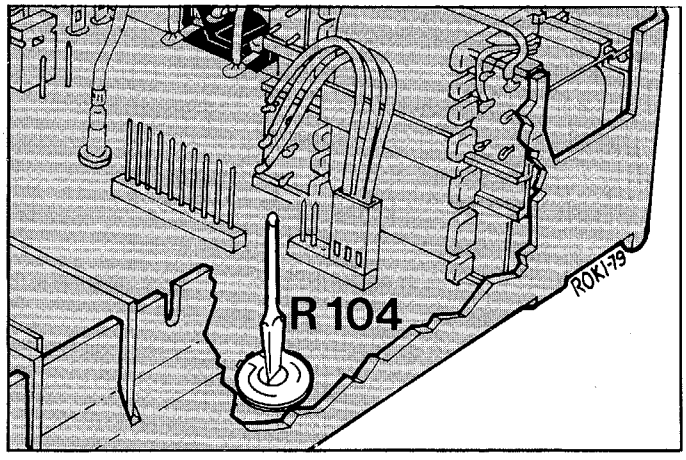
— Remove housing.
— Connect reference signal to LF input.
— Adjust C106 to read 9999.999kHz on display.



12.3. DC balance adjustment

Equipment required:
LF sinewave generator and LF oscilloscope.

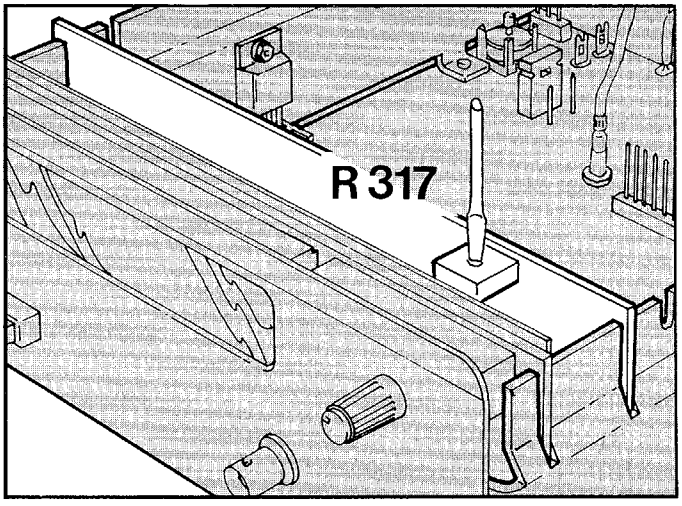
— Connect sinewave generator (set to approx. 1kHz and 30mV$_{RMS}$) to LF input of counter.
— Connect oscilloscope between pin 7 of IC103 and ground.
— Adjust R104 until displayed square-wave has a duty-factor of 0.5.
— Decrease input amplitude to 15mV$_{RMS}$ and fine-adjust R104 for a dutyfactor of 0.5 on oscilloscope display.



12.4. RF enable adjustment (PM 6668 only)

Equipment required: 1GHz signal generator

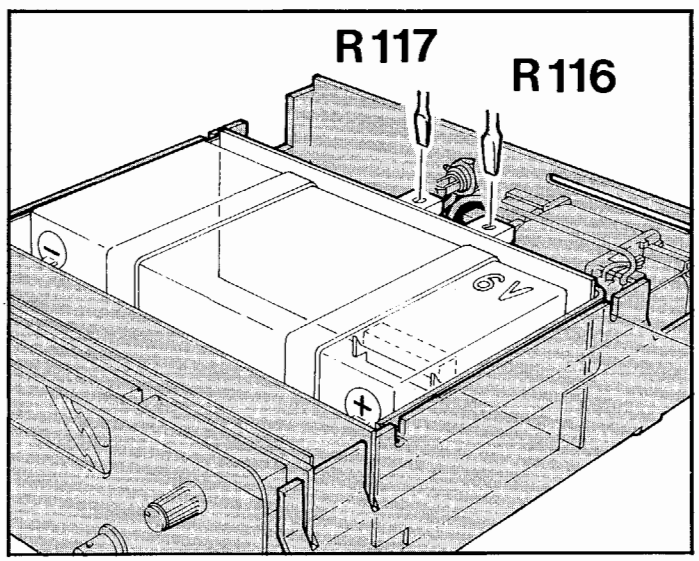
— Connect signal generator to RF input of counter.
— Set signal generator to 70MHz and 15mV$_{RMS}$.
— Check that counter displays a stable 70MHz read-out.
— If there is no read-out, adjust R317.
— Set signal generator to 500MHz and 800MHz. Check read-out at each frequency and adjust R317 if required.
— Set signal generator to 1000MHz, 25mV$_{RMS}$ and check read-out.
— Repeat the procedure and readjust if required.



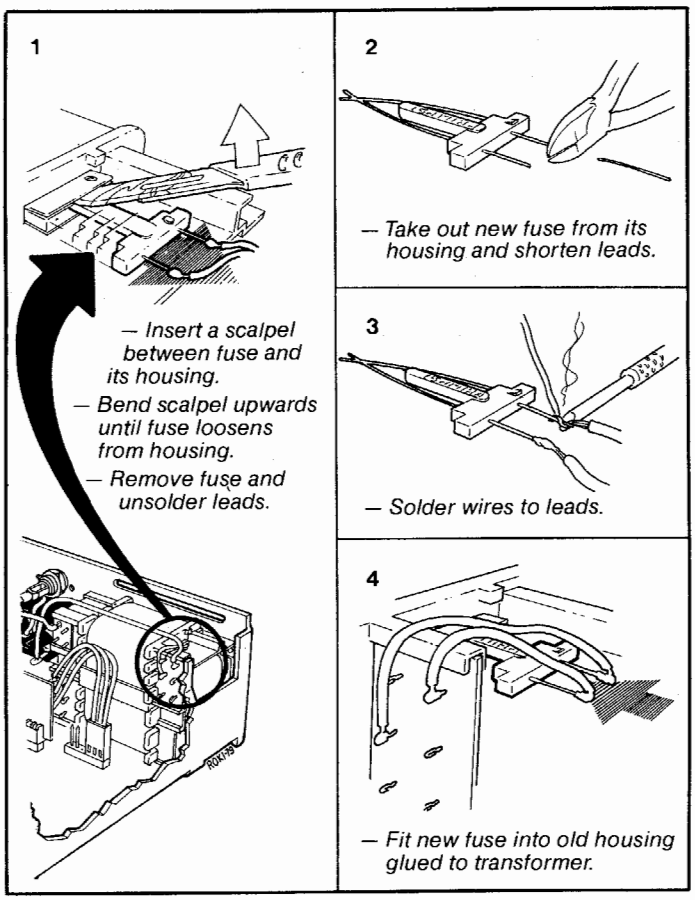
12.5. Battery unit adjustment

Equipment required:
Digital voltmeter

– Connect voltmeter between pin 2 of IC103 and ground.
– Adjust R117 until voltage is +2V ±50mV.
– Remove fuse VL101.
– Connect voltmeter to plus pole of battery and ground and adjust R116 until voltage is +6.9V ±50mV. (at +20 . . . +25°C)
– Reinstall fuse.



13.2. Fuse replacement



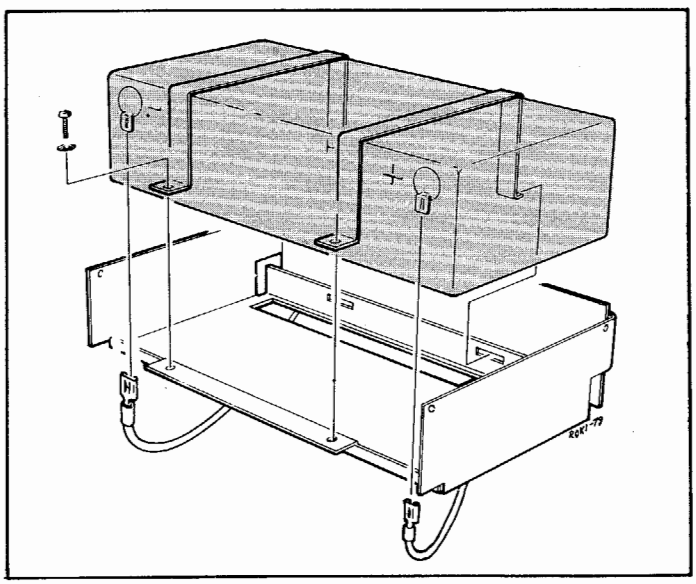
13. Replacing parts

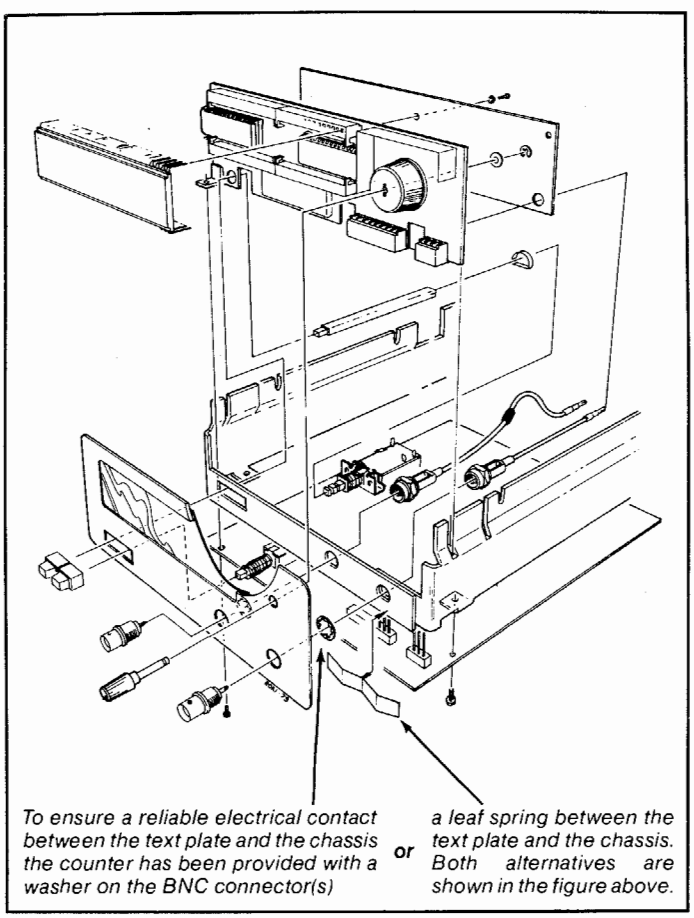
13.1. Battery replacement

– Loosen the four side-wall screws and remove battery unit.
– Remove screws at holding brackets.
– Detach fast-on connectors.
– Pull up battery.

Note: Check that the plus pole of the new battery is at the right-hand side (viewed from battery connector side).

See figure below.





To ensure a reliable electrical contact between the text plate and the chassis the counter has been provided with a washer on the BNC connector(s) **or** *a leaf spring between the text plate and the chassis. Both alternatives are shown in the figure above.*

14. Trouble-shooting circuit diagrams and spare parts

General

The PM 6667 and PM 6668 are provided with a built-in self-diagnosis routine that is performed when the counter is switched on. If certain faults are present, this is shown on the display as one of six error codes, i.e. "Error 1" through "Error 6".

The fault-finding diagrams Error 1 . . . 6 make it possible to isolate the fault to the microprocessor, certain IC's or other sources.

"Conventional" faults occurring in, e.g., the power supply or the input circuitry are normally not generating an "Error" indication.

If the counter does not operate properly, switch off the power and then switch on again. Check whether an error code is displayed. If not, trouble-shoot in the conventional way (measure DC voltages, check waveforms etc.). If an error code is displayed, check the relevant diagram.

The "Error" indication can be removed as follows:

— Ensure that an input signal is connected.

— Press or release the MEASUREMENT RATE button once or a couple of times.

Unless the fault has been remedied, the "Error" code is displayed again as soon as the counter has been switched off and then on again.

Self-check at Power On

Once Power On has been switched on, the µC performs a self-check including a diagnosis routine. The self-check consists of three parts:

1 Test of program memory by means of software signature analysis of the µC.

2 Test of data memory.

3 A test that the µC can set the external logic to zero.

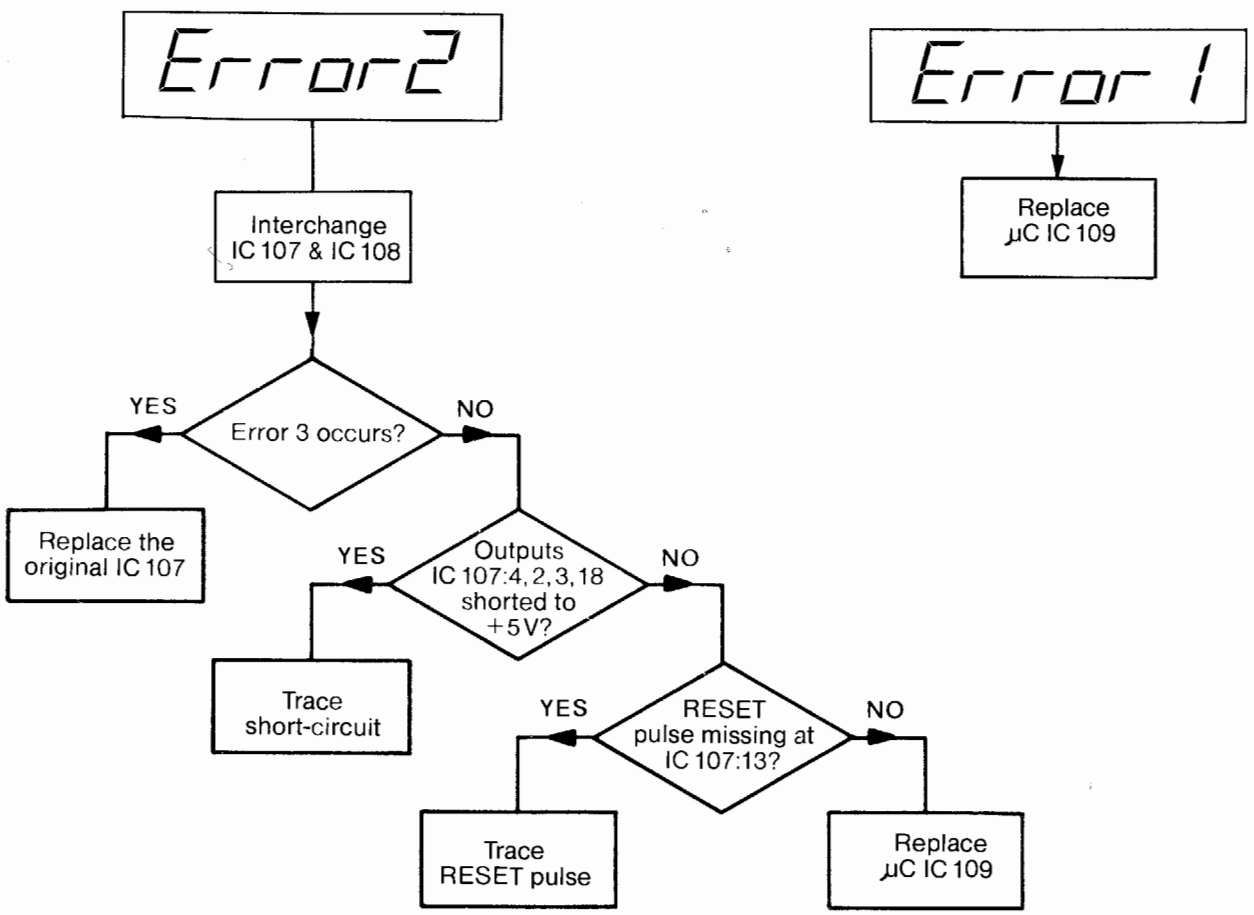
All segments, decimal points and units are visible on the display during the test. This makes it possible for the operator of the counter to check the function of the display.

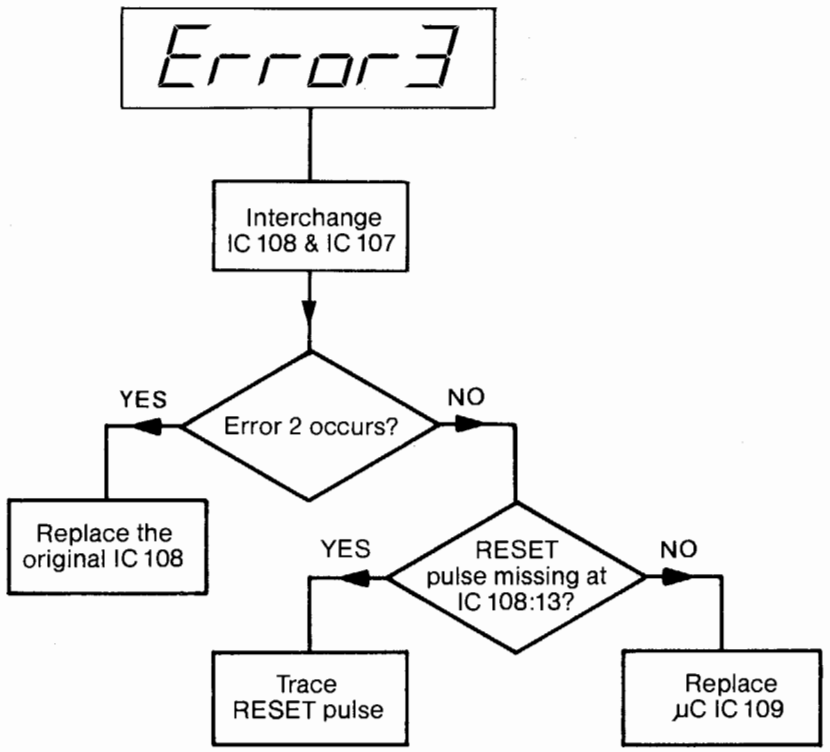
If the test fails during the test of program memory or data memory, the code Error 1 will be displayed.

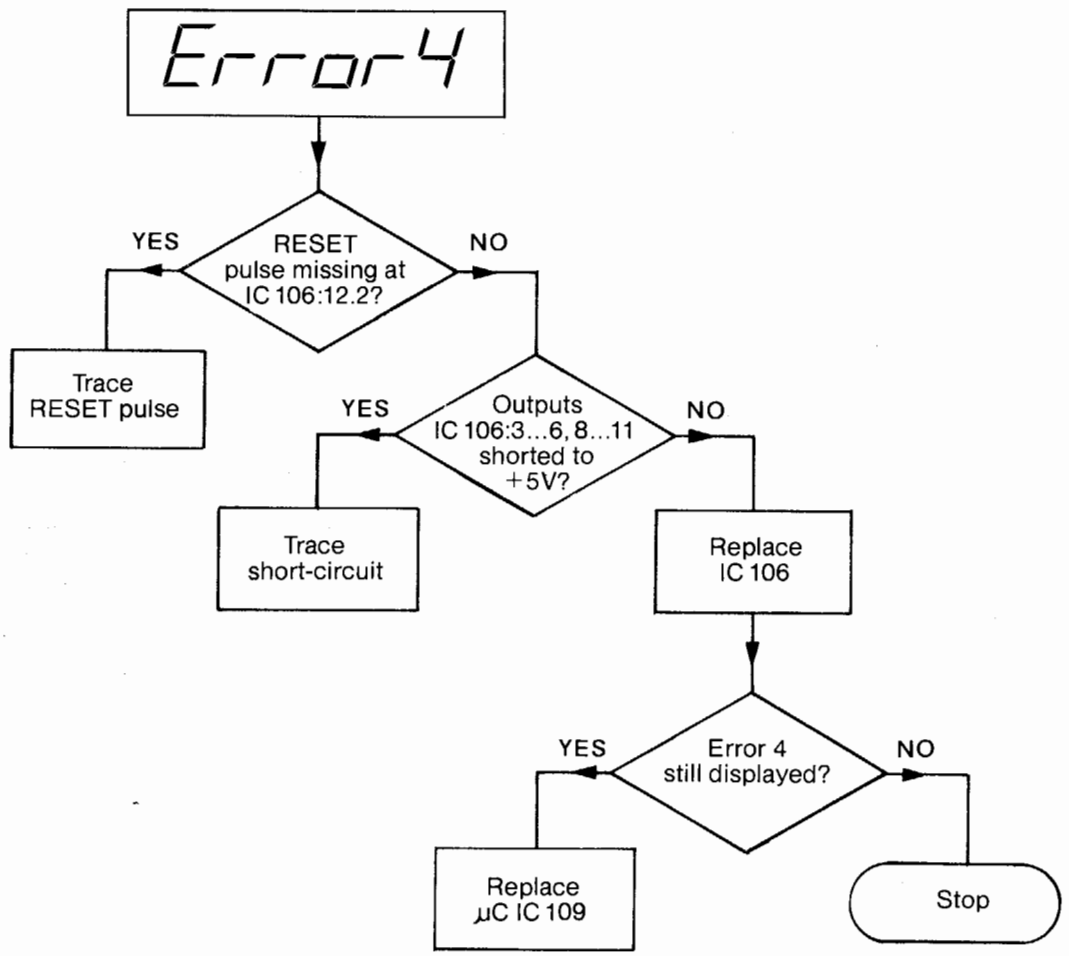
If, however, the test that the µC can set the external logic to zero fails, there will be an Error code between 2 and 6 depending on where the faulty part is.

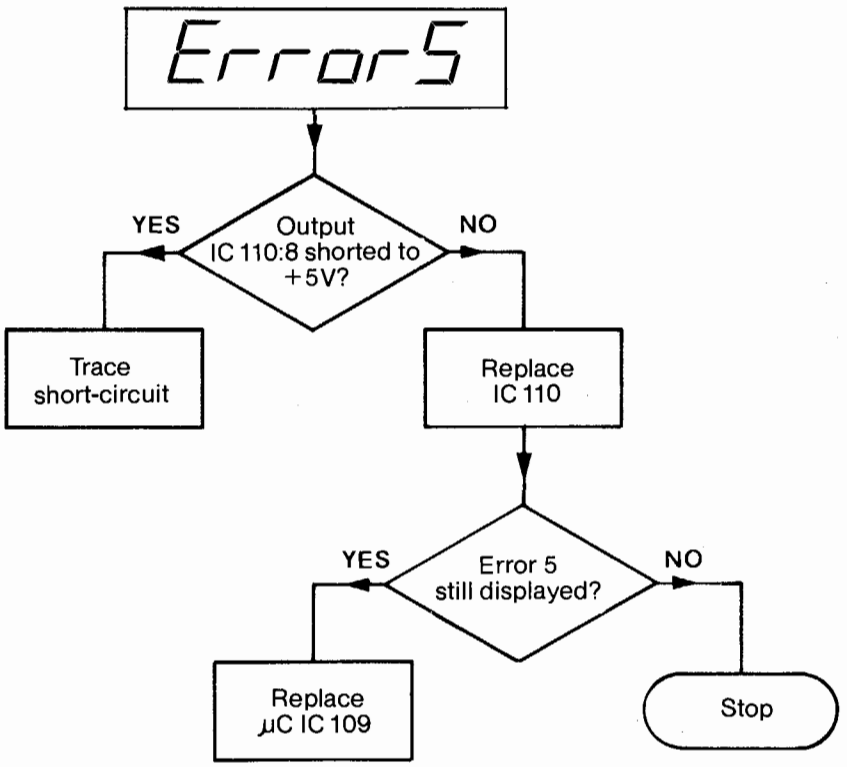
NOTE: The diagrams illustrate the faults that are most likely to occur in the microcomputer circuitry. Other fault combinations may be possible which also generate an "Error" code or a nonsense display read-out.

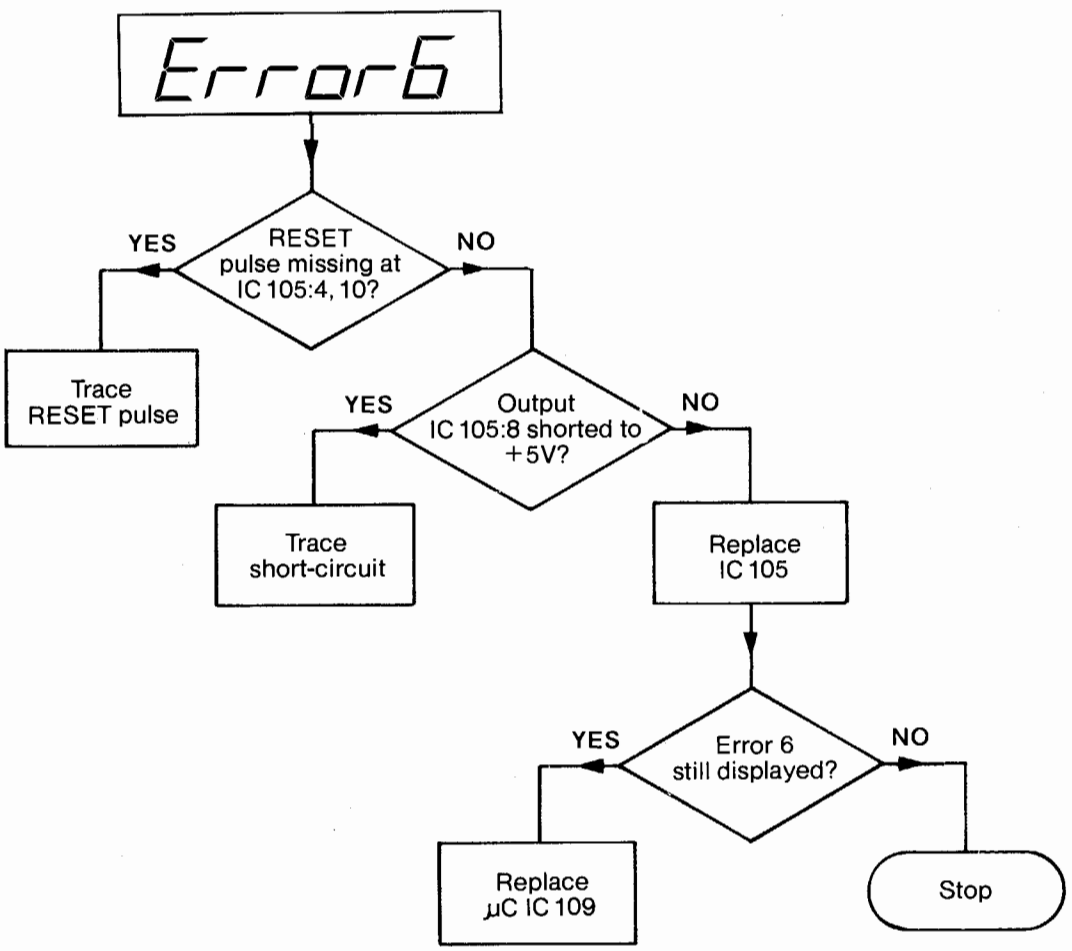
Always check the DC supply voltage before any replacements are made!



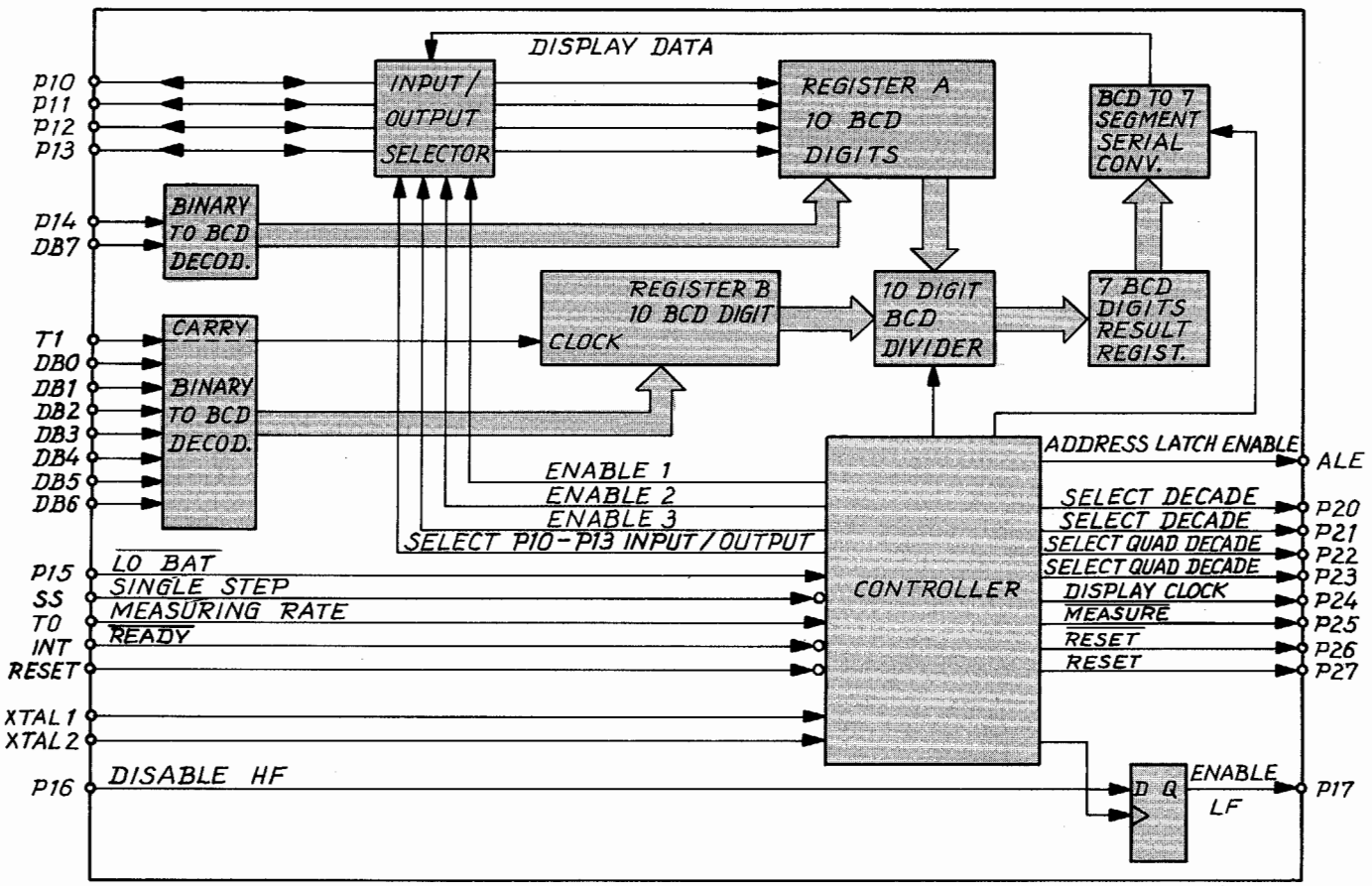

Error3
Interchange IC 108 & IC 107
Error 2 occurs?
YES
NO
Replace the original IC 108
RESET pulse missing at IC 108:13?
YES
NO
Trace RESET pulse
Replace µC IC 109


Error4
RESET pulse missing at IC 106:12.2?
YES
NO
Trace RESET pulse
Outputs IC 106:3...6, 8...11 shorted to +5V?
YES
NO
Trace short-circuit
Replace IC 106
Error 4 still displayed?
YES
NO
Replace µC IC 109
Stop


Error5
Output IC 110:8 shorted to +5V?
YES
NO
Trace short-circuit
Replace IC 110
Error 5 still displayed?
YES
NO
Replace µC IC 109
Stop


Error6
RESET pulse missing at IC 105:4, 10?
YES
NO
Trace RESET pulse
Output IC 105:8 shorted to +5V?
YES
NO
Trace short-circuit
Replace IC 105
Error 6 still displayed?
YES
NO
Replace µC IC 109
Stop

The Microcomputer



Application block diagram.

How the result is calculated and the presentation is done

By programming the µC with a program that controls measurements, performs calculations and presents the result on the display, the µC has got an application with well specified functions. This application of the 8048 µC is illustrated in the "Application block diagram of the µC". This description is based upon this illustration, the "Functional diagram" and the "Signal path diagram".

The Controller performs all communication of control signals, internally in the µC as well as externally with the rest of the logics in the counter.

The pins P10—P13 can be used both as inputs as well as outputs. The mode in which they shall work is decided by the controller and executed by the "Input/output selector".

After elapsed measuring time the result of the event signal is kept in the Event counter, IC 105, 107, 108 and 110.

The result in the two divide-by-2 counters IC105 and IC110 are transferred to P14 and DB7. It is converted from binary notation to BCD code and stored in "Register A".

The result in the two Quad decades IC107 and IC108 are transferred to the pins P10—P13. The controller sets them to be inputs. The controller also sets the pins P20—P23 so that the uC can read the content in every single decade within each Quad decade. The result is stored in Register A together with the result from the two divide-by-2 counters.

The Timer Counter has two registers. One register with 256 bits, ≈ 2.5 digits, in IC 106 to take care of the 10 MHz signals. The other one in the "10 BCD digit Register B". The carry signal from IC106:8 has a frequency of 10 MHz divided by 256. The carry signal is connected to T1 and is counted and registered in Register B. After elapsed measuring time the result in IC106 is transferred via T1 and DB0—DB6 to the Register B after it has been decoded from binary notation to BCD code in the "Binary to BCD decoder".

The results in Register A and Register B are divided in the "10 digit BCD divider". After this calculation only the 7 most significant digits are stored in the "7 digit result register".

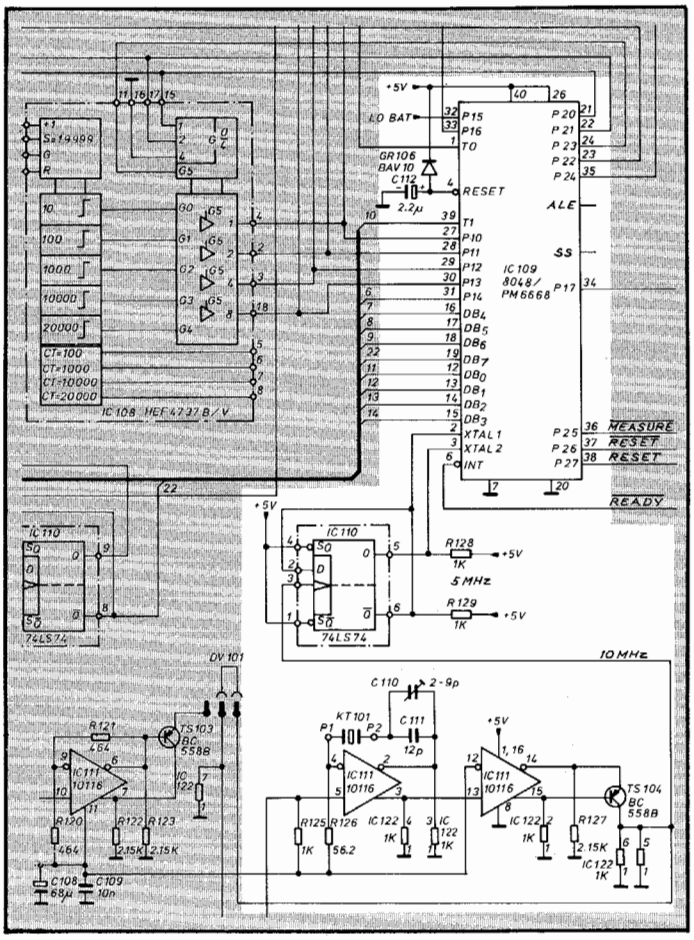
In the "BCD to 7 segment serial converter" the 7 BCD digits are transferred into 7 segment information in serial form. In this block the decimal point, units and LO BAT are added.

Via the "Input/output selector" the pins P10—P13, are set in output mode, the 64 bits display Data signal, the Enable1, 2 and 3 signals are transferred to the display driver circuits IC 201, 202 and 203. To complete the necessary information to the display the controller sends out the "Display clock" signal on port P24.

The µC needs a clock signal

The external clock signal needed for the µC is a 5 MHz signal taken from the 10 MHz reference signal and divided by two in IC 110.

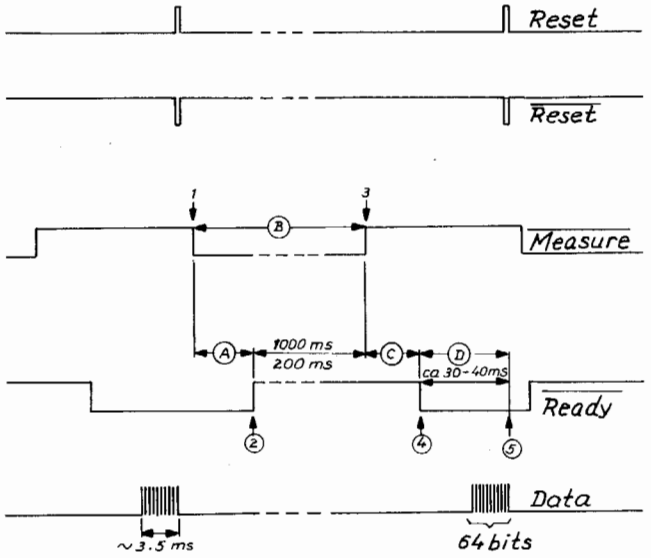
This 5 MHz clock signal has nothing to do with the resolution and accuracy specification but it must always be present to get the µC running. It is important that the internal oscillator is operating since it can not be replaced with an external reference signal. The internal reference oscillator is either a standard crystal oscillator or an optional TCXO.



Five important pins on the µC IC 109

- Check that there is a 5 MHz signal on pin 2 and 3.
- If there is a 5 MHz signal on pin 2 and 3, there should be a 333.3 kHz pulse train on pin 11 having TTL levels.
- If there is no signal on pin 11, check that pin 4 is high.
  After POWER ON has been switched on and the + 5 V supply voltage has reached the + 4.75 V level, the capacitor C 112 will keep pin 4 low (< + 0.8 V) during at least 50 ms.
- If there is no signal on pin 11 and pin 4 is high, check that pin 5 is high.
  This is a single step input that makes the program stop when level is low.

Timing Diagram



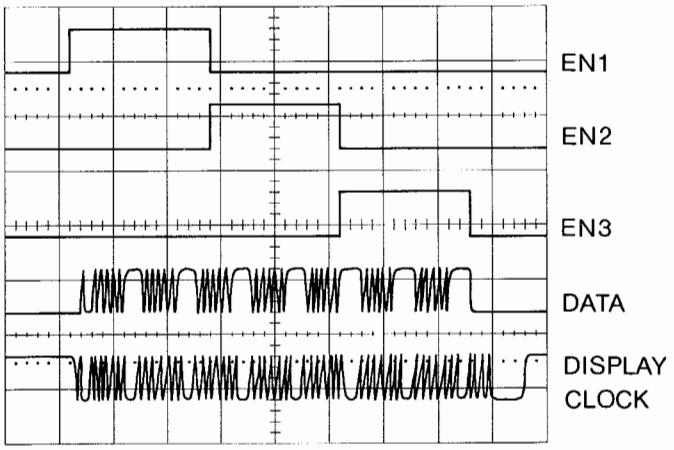
(A) *The time interval between MEASURE goes low and READY goes high is depending on the input frequency. The lower limit is 1 to 2 periods of the input signal. The upper limit is 270 ms.*

(B) *If there is no input signal or the frequency is too low, MEASURE will be low for 270 ms.*

(C) *The time interval between MEASURE goes high and READY goes low is depending on the frequency of the input signal. Maximum is 1.2 s.*

A new measurement cycle starts when $\overline{\text{MEASURE}}$ goes low ①, waiting for an event signal to occur. If no event signal occurs within 270 ms Ⓐ the $\overline{\text{MEASURE}}$ goes high again. During the time $\overline{\text{MEASURE}}$ is low the µC is ready to start a new measurement cycle. If, however, an event signal occurs during the 256 ms waiting time, this will clock $\overline{\text{MEASURE}}$ to be a high $\overline{\text{READY}}$ signal ② at IC 105:2, 3, 6. The time when $\overline{\text{READY}}$ is high is the actual measuring time. During this time event signals are counted in the Event counter and the 10 MHz reference signal is counted by the Time counter. Depending on whether FAST or NORMAL MEASUREMENT RATE is chosen, the µC sets the time for $\overline{\text{MEASURE}}$ to go high ③. The Synchronizer and Gate control ensure that only whole periods of the event signals are counted in the Event counter. The time interval Ⓒ between $\overline{\text{MEASURE}}$ going high ③ and $\overline{\text{READY}}$ going low ④ is therefore depending on the input frequency. The time interval Ⓒ is maximum 1.2 s. The time interval Ⓓ between $\overline{\text{READY}}$ going low ④ and the 64 bits data are transferred to the display ⑤ is the computing time of 30—40 ms. During the computing time the result is calculated and transferred in serial form to the display.

Wrong display read-out



TTL levels 500 µs/div.

Presentation of the zeros on the display.

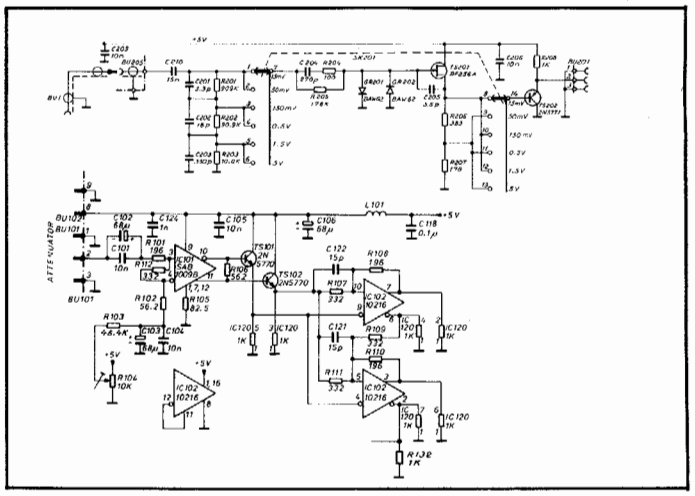
Step 1. Check the Data, Clock and Enable Signals to the Display PCB, according to the photo.

Step 2. If step 1 is correct but there is still no read-out, check the Display PCB.

Step 3. If step 1 is false, check the "Five important pins on the µC".

Step 4. If step 1 and the Display PCB is correct and there is still no significant read-out, the trouble is most likly found in the logic circuits on PCB 1.

Input Amplifier



The input amplifier is divided into two parts on different PCB:s. The input network, the six-step sensitivity control and the impedance converter are located on U2. The amplifier and the auto-trigger are located on U1.

The sensitivity control consists of two parts. One three-step attenuator in the high impedance part and a two-step gain control of the impedance converter TS 201.

IC 101 is an integrated amplifier with fixed gain. The amplification is controlled by means of R 106 and R 112. R 112 is factory selected. To obtain higher amplification equal to more sensitivity, R 106 can be increased. The recommended minimum value of R 106 is 562 Ohms.

TS 101 and TS 102 acts as interface between IC 101 and the auto-trigger.

A description of the Auto Trigger is found in chapter 10.2. Block diagram description.

How to measure on the Liquid Crystal Display

An LCD is working in an AC mode. IC 201, containing the Backplane oscillator, works in a master mode. IC 202 and IC 203 are slaves. The frequency of the Backplane oscillator is set to approximately 60 Hz by C 207.

As long as the segments are not visible the segment input and the back-plane are oscillating in the same phase and with the same frequency. When, however, the segments are visual (black) the segment input is oscillating 180° out of phase to the back-plane. This requires a two channel oscilloscope when trouble shooting the LCD. One channel is applied to the back-plane BU 204:1 or 10 and is used as the trigger channel. The other channel is then used for fault finding the information flow from the display drivers to the LCD.

If the Backplane oscillator stops oscillating or a DC voltage is applied across the Backplane (BPD) and one or more segments for a longer time the LCD might be damaged.

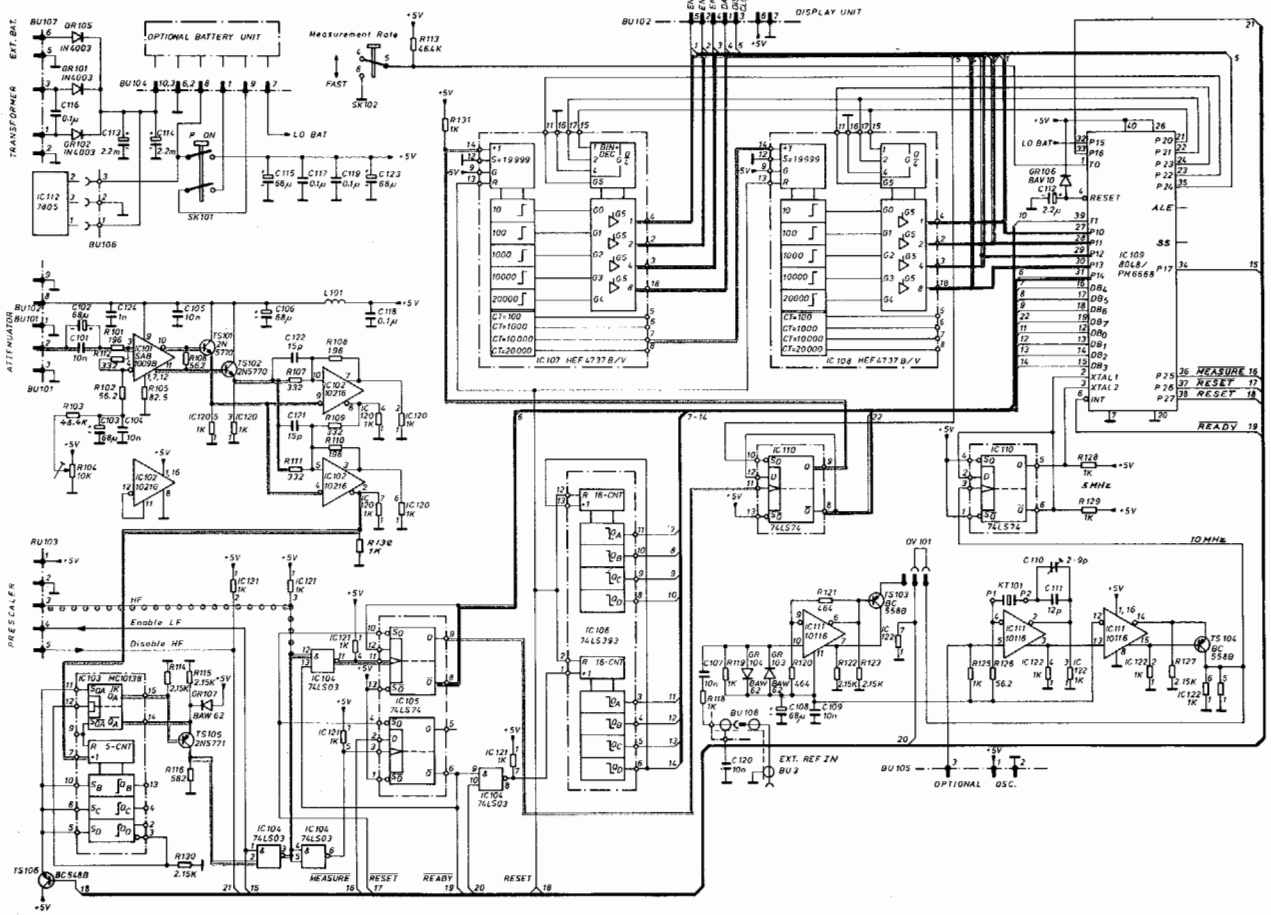
Synchronizer and Gate control

The µC controls the timing of every measurement cycle via the Synchronizer and Gate control. This circuit synchronize the start and stop of the event and time reference signals so that only whole periods of the event signal are counted. (See fig. 10.2).

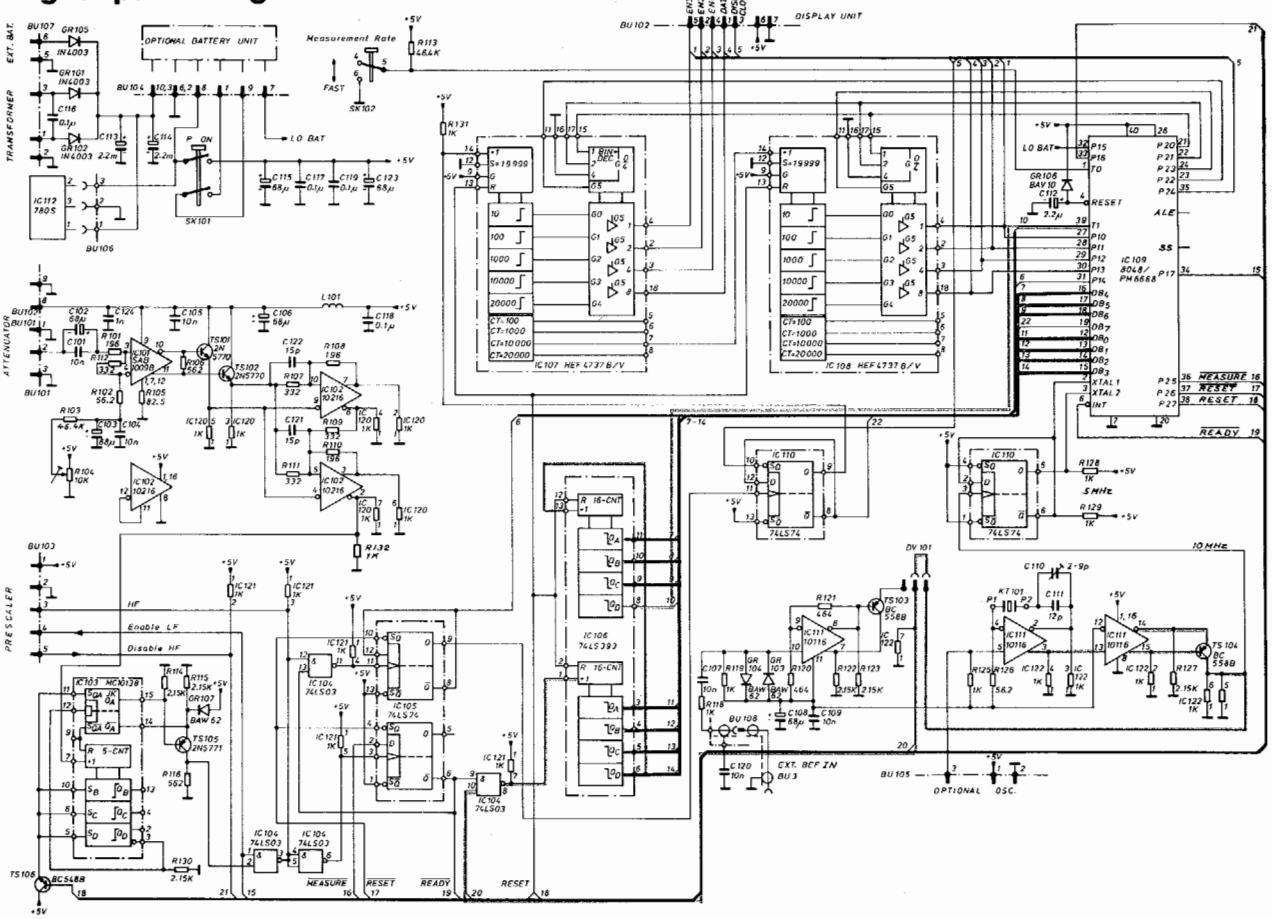
The signal path through the Event and Time counters are indicated with blue in the signal path diagram.

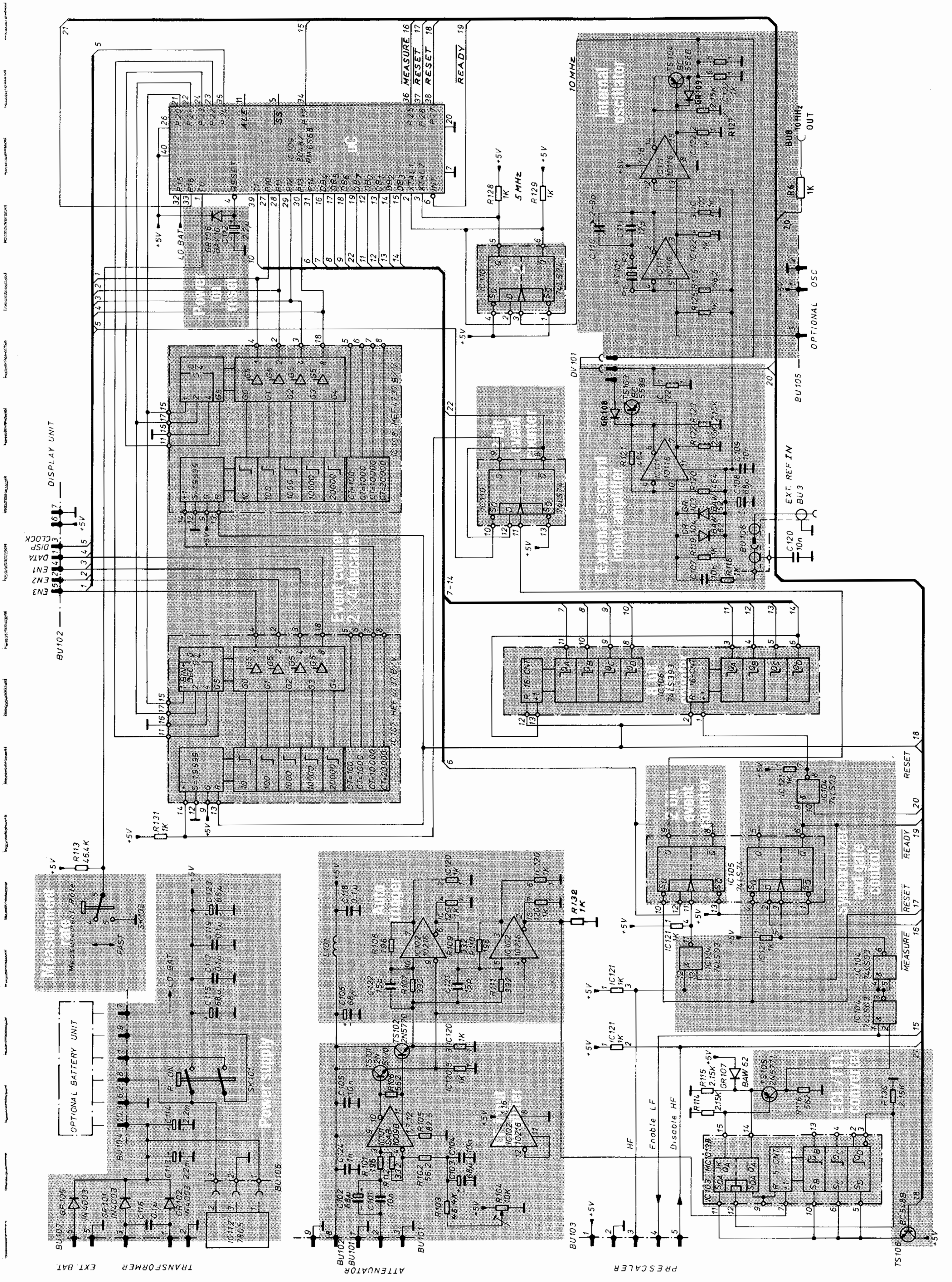
The µC reads the content in the Event counter and the Time counter after the measuring time has elapsed. This is indicated by the red signals in the signal path diagram. It calculates the result and converts it to a 64 bit serial information including clock and enable signals needed for correct presentation on the 7 digit LCD.

Signal path trough the Event counter

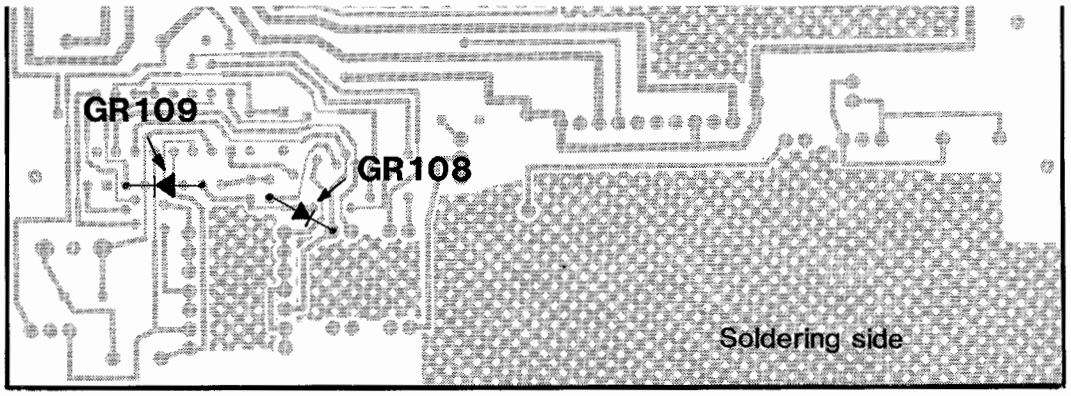


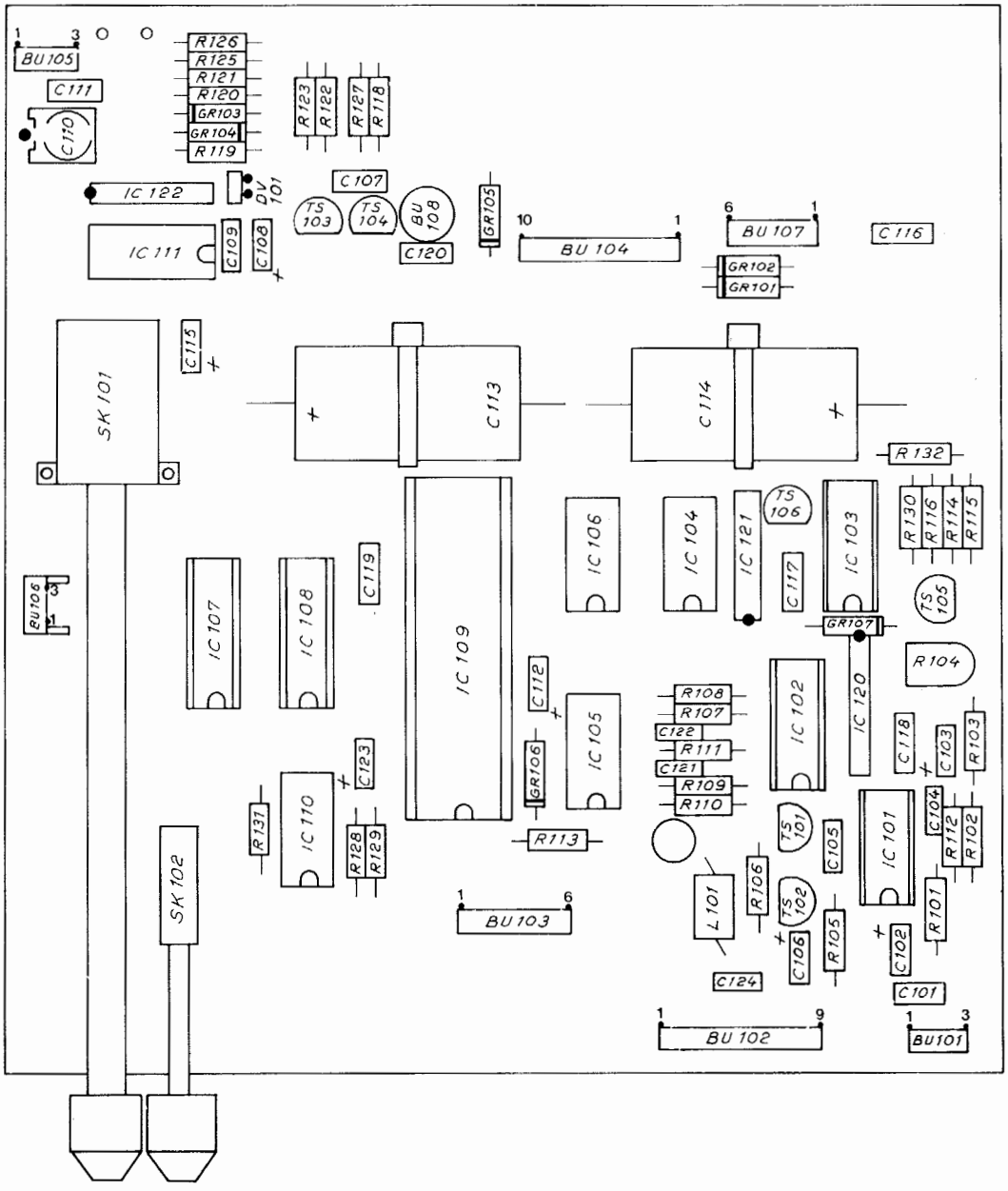
Signal path trough the Time counter

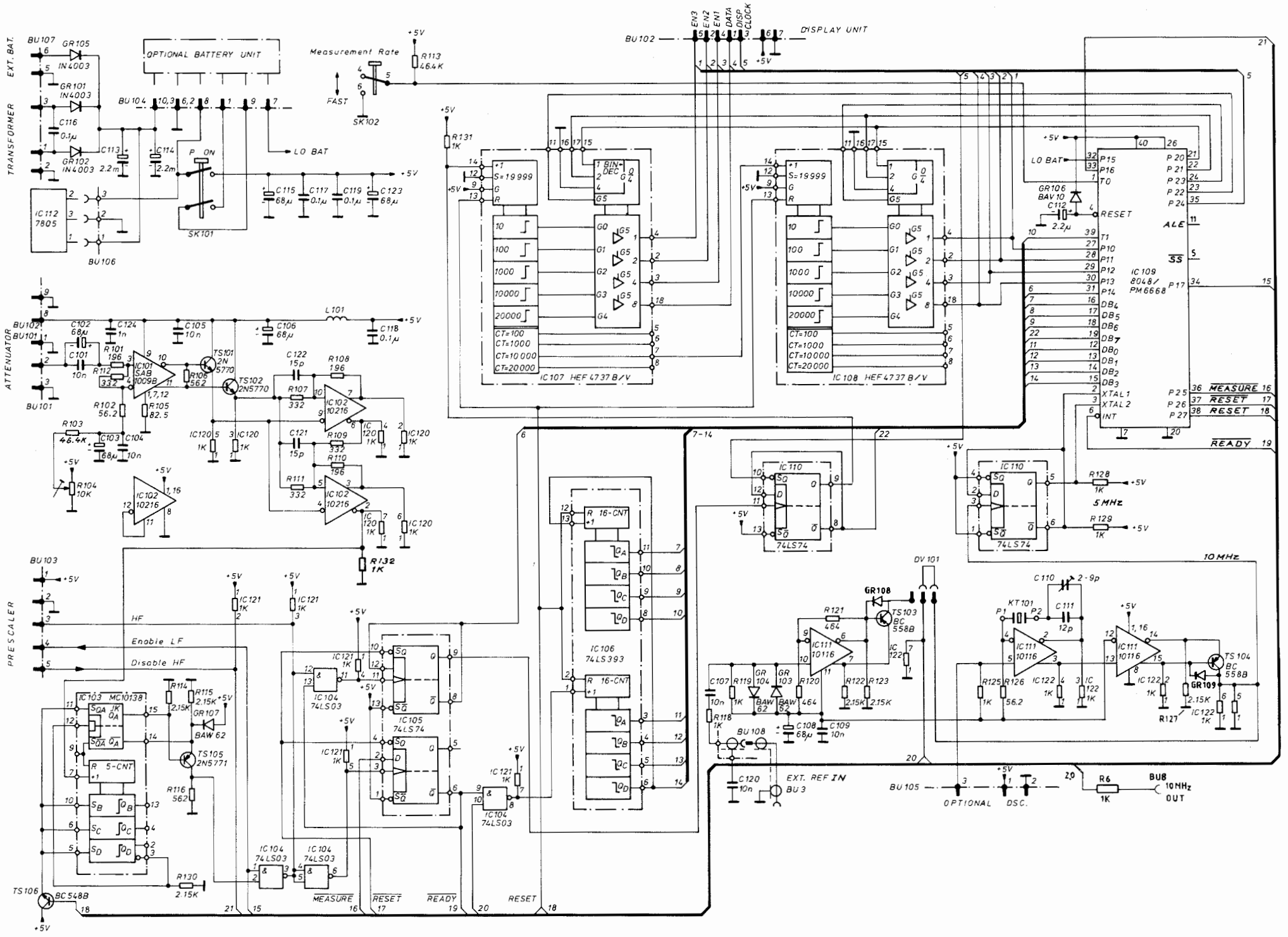



Internal oscillator
External standard input amplifier
Event counter 2 × 4 decades
Power supply
Auto trigger
Measurement rate
Synchronizer and gate control
ECL/TTL converter
Power on reset
DISPLAY UNIT
OPTIONAL BATTERY UNIT
EXT. BAT
TRANSFORMER
ATTENUATOR
PRESCALER
EXT. REF IN
OPTIONAL OSC
MEASURE
RESET
READY

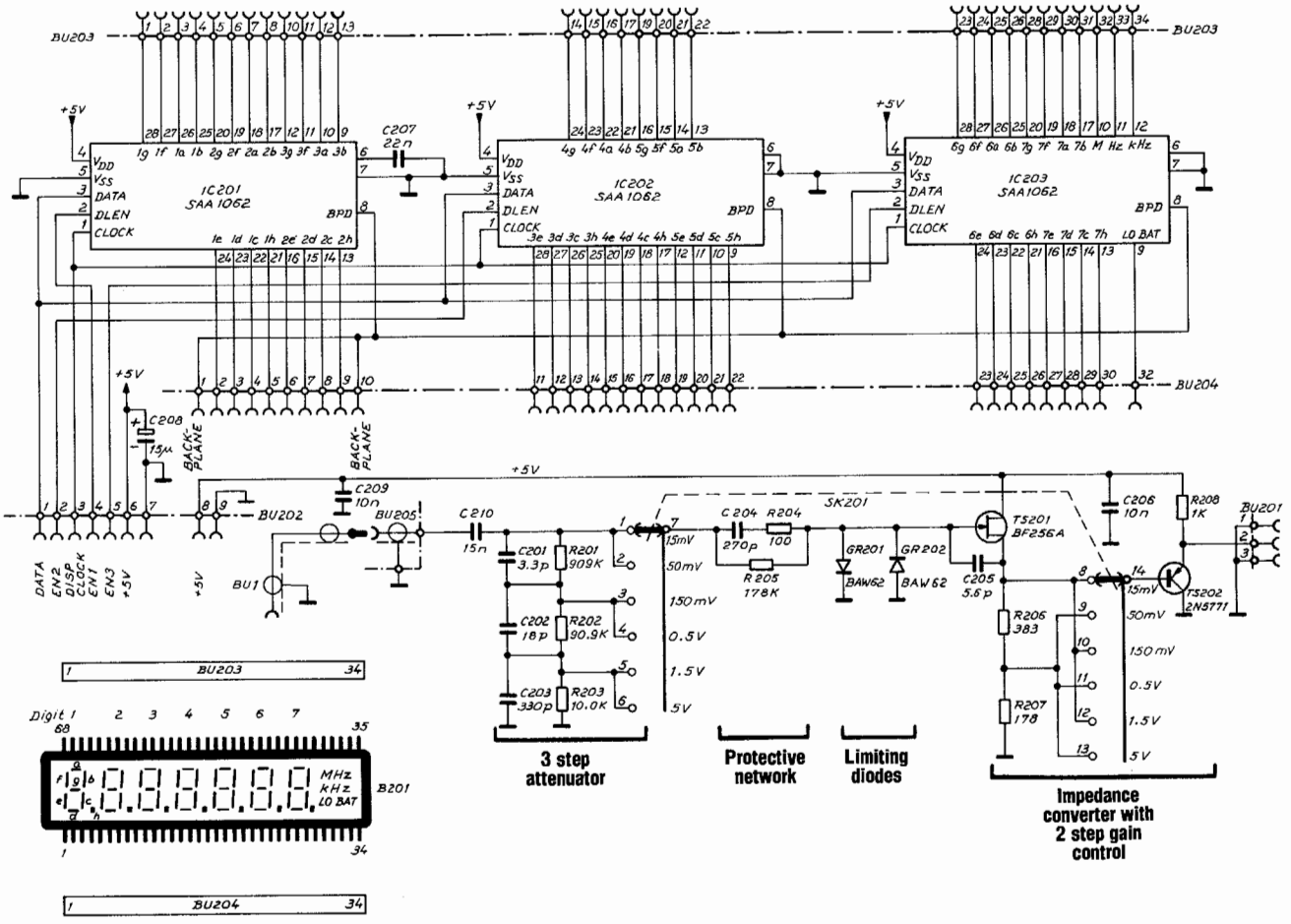
Basic board Unit 1

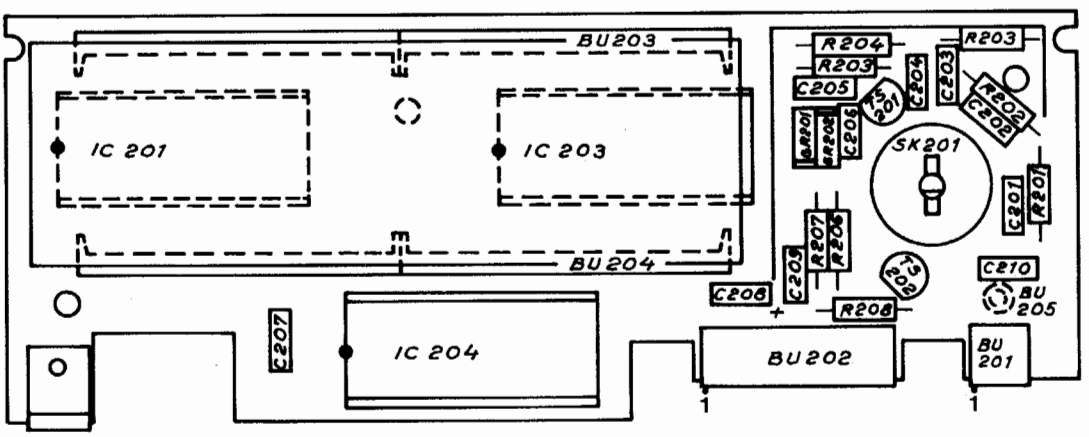




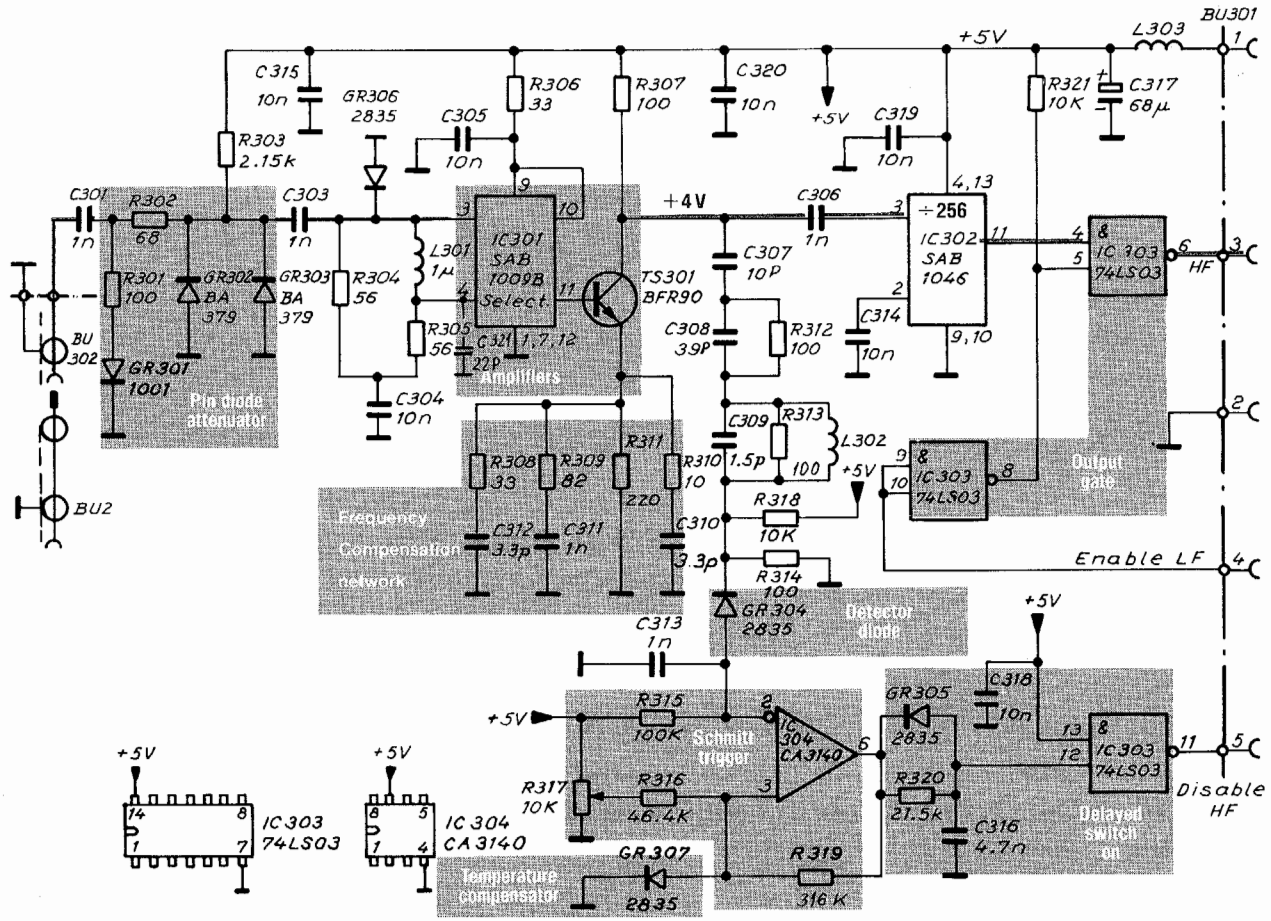

EXT. BAT.
TRANSFORMER
OPTIONAL BATTERY UNIT
BU107
GR105
IN4003
GR101
IN4003
GR102
IN4003
BU104
C116
0.1µ
C113
2.2m
C114
2.2m
P ON
LO BAT
+5V
C115
68µ
C117
0.1µ
C119
0.1µ
C123
68µ
IC112
7805
SK101
BU106
Measurement Rate
FAST
SK102
R113
46.4K
BU102
DISPLAY UNIT
EN3
EN2
EN1
DATA
DISP CLOCK
R131
1K
IC107 HEF4737B/V
IC108 HEF4737B/V
BIN-DEC
CT=100
CT=1000
CT=10000
CT=20000
IC109
8048/
PM6668
LO BAT
GR106
BAV10
C112
2.2µ
RESET
ALE
SS
READY
MEASURE
RESET
RESET
XTAL1
XTAL2
INT
ATTENUATOR
BU102
BU101
L101
C102
68µ
C124
1n
C105
10n
C106
68µ
C118
0.1µ
C101
10n
R112
332
IC101
SAB
1009B
R101
196
R106
562
TS101
2N
5770
TS102
2N5770
R102
56.2
R105
82.5
R103
46.4K
C103
68µ
C104
10n
R104
10K
C122
15p
R108
196
R107
332
IC102
10216
C121
15p
R109
332
R110
196
R111
332
IC120
1K
R132
1K
7-14
IC110
74LS74
5MHz
R128
1K
R129
1K
10MHz
DV101
GR108
TS103
BC
558B
R121
464
IC111
10116
IC122
1K
C110
2-9p
KT101
C111
12p
GR109
TS104
BC
558B
R125
1K
R126
56.2
R127
2.15K
C107
10n
R119
1K
GR
104
BAW
62
GR
103
BAW
62
R120
464
R122
2.15K
R123
2.15K
R118
1K
BU108
C108
68µ
C109
10n
C120
10n
EXT. REF IN
BU3
BU105
OPTIONAL DSC.
R6
1K
BU8
10MHz
OUT
PRESCALER
BU103
HF
Enable LF
Disable HF
IC103
MC10138
R114
2.15K
R115
2.15K
GR107
BAW 62
TS105
2N5771
R 5-CNT
R116
562
R130
2.15K
TS106
BC548B
IC121
1K
IC104
74LS03
IC105
74LS74
IC106
74LS393
R 16-CNT
MEASURE
RESET
READY
RESET

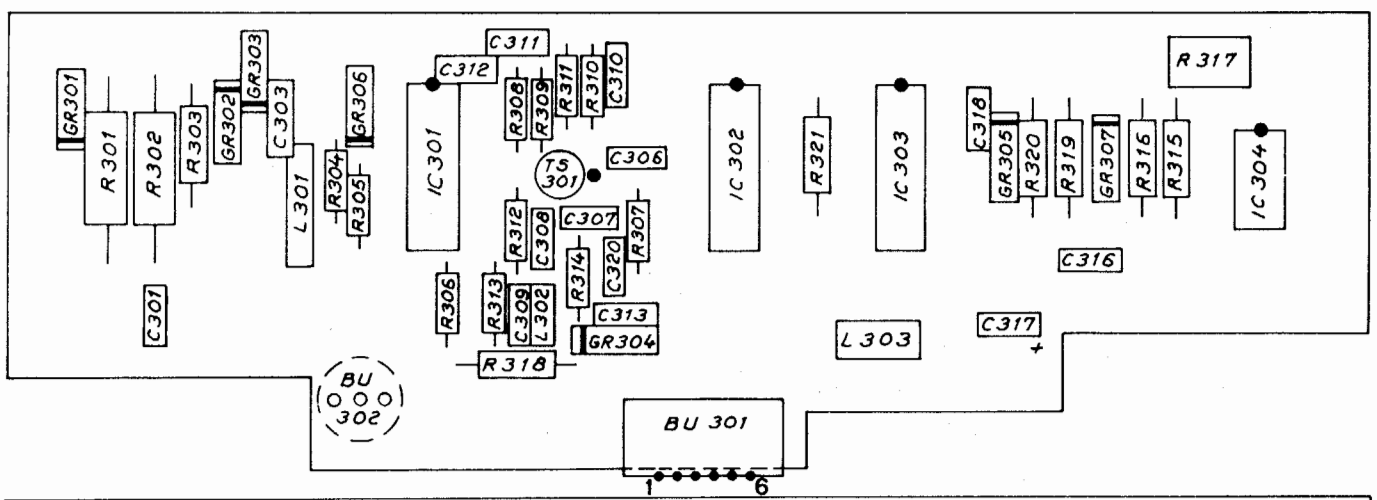
Input amplifier and display drivers Unit 2

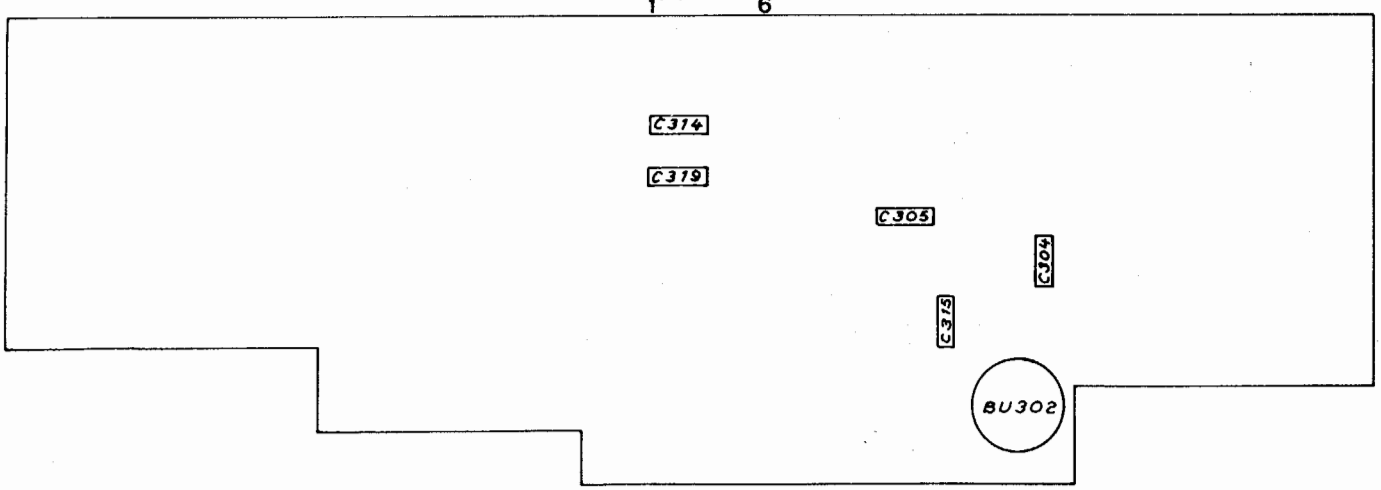




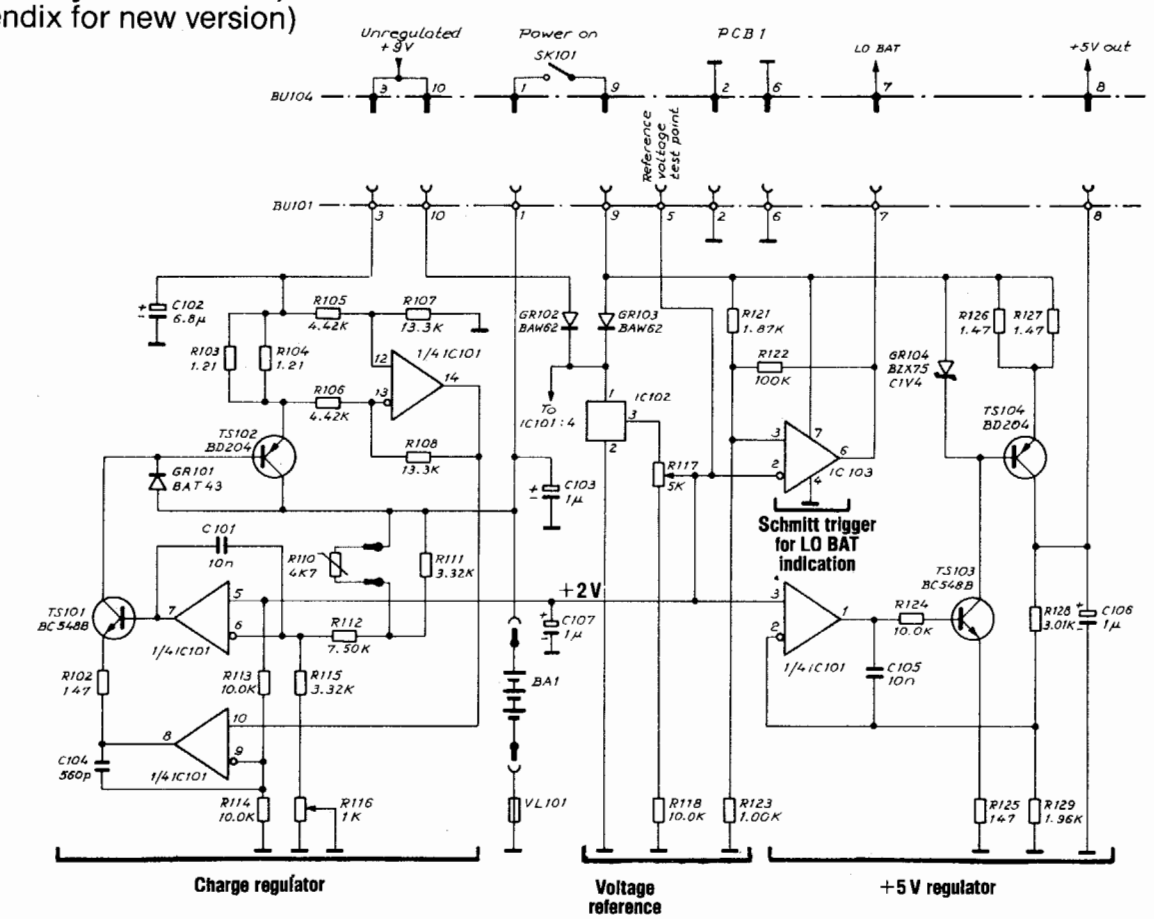
Prescaler Unit 3

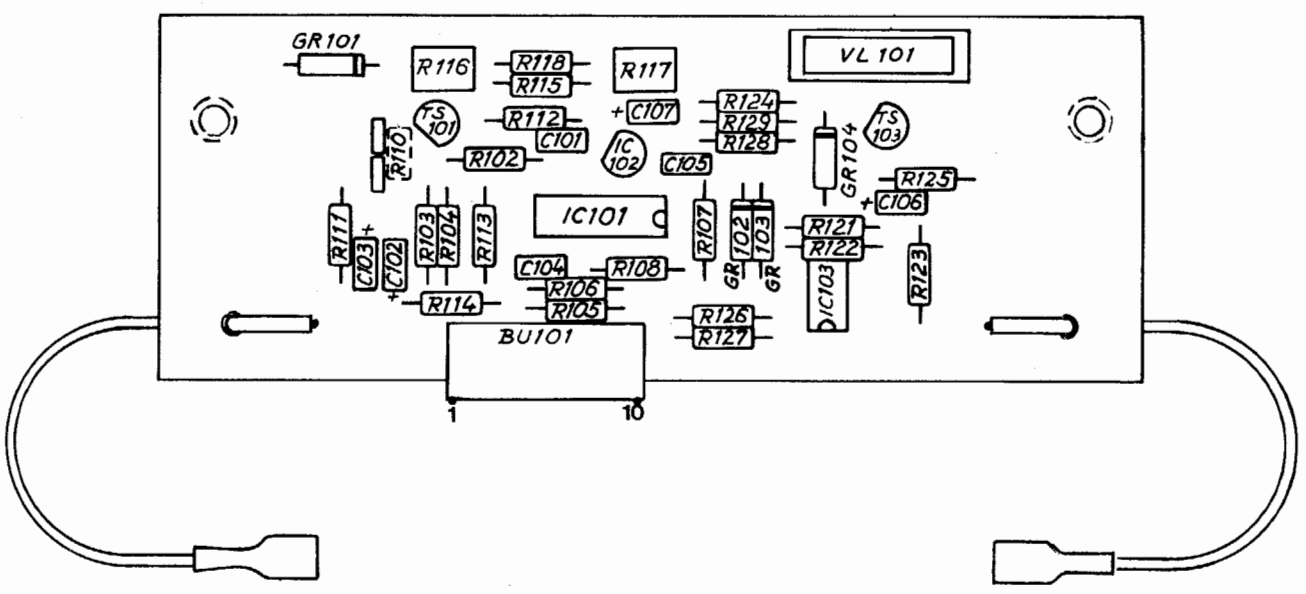




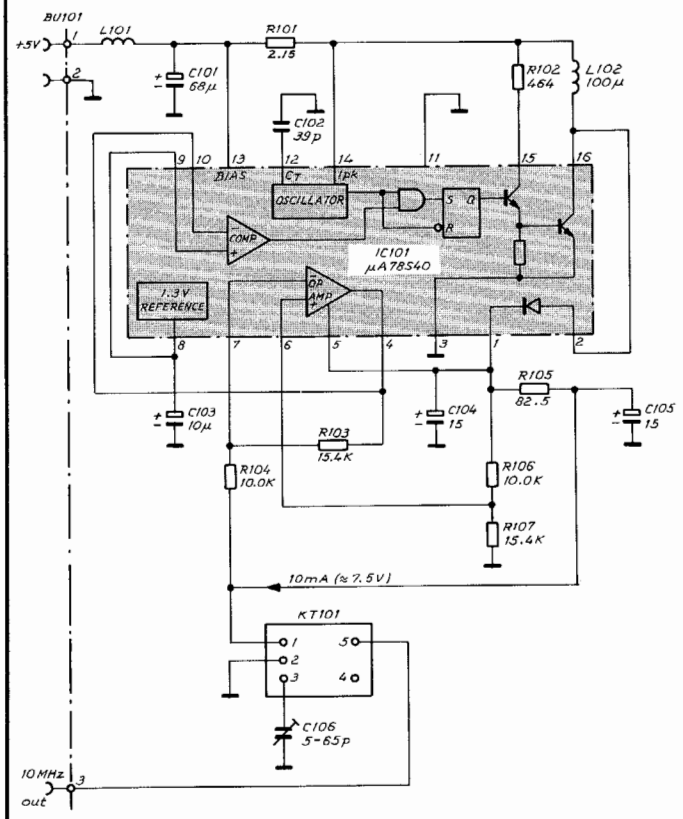


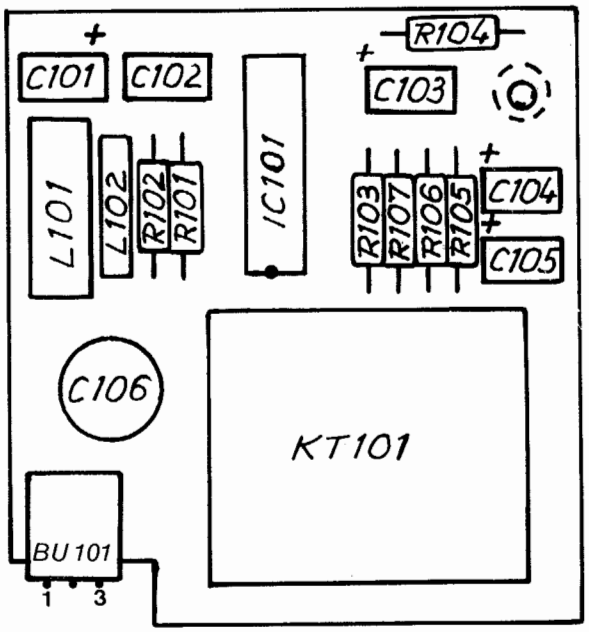
Optional battery unit PM 9601, old version
(See appendix for new version)



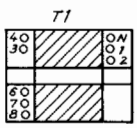


TCXO / 02

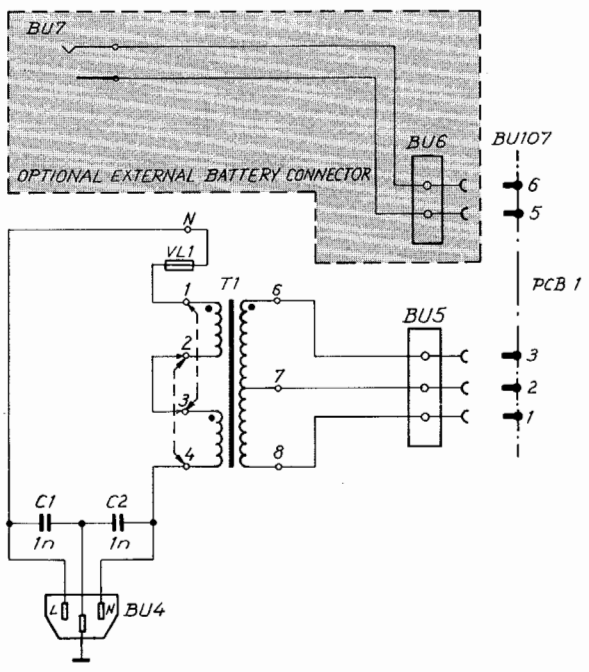




External battery jack and mains transformer

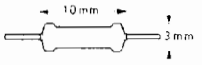


Mains voltage	Interconnect.
230V	2-3
115V	1-3 , 2-4



Lacquered Metal Film
Manufacturer: Philips
Type: MR30

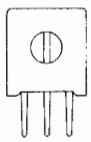
P at 70°C: 0.5 W
Tolerance: 1 %



Ω	Ordering Number
909k	5322 116 54408

Ceramic Potentiometers
Manufacturer: Beckman
Type: Cermet 72X

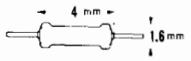
P at 70°C: 0.5 W
Tolerance: 10%



Ω	Ordering number
1 k	5322 101 14299
5 k	5322 101 14301
10 k	5322 101 14254

Carbon Film
Manufacturer: Philips
Type: CR16

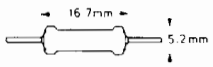
P at 70°C: 0.2 W
Tolerance up to 220 k: 5 %
Tolerance from 270 k: 10 %



Ω	Ordering Number
10	4822 111 30349
22	5322 111 30396
33	4822 111 30067
56	5322 111 30074
82	4822 111 30352
100	4822 111 30324
220	4822 111 30327
330	4822 111 30328

Power Metal Film
Manufacturer: Philips
Type: PR52

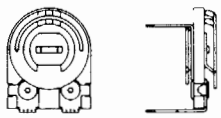
P at 70°C: 2.5 W
Tolerance: 5 %



Ω	Ordering Number
68	5322 116 54396
100	5322 116 54392

Ceramic Potentiometers
Manufacturer: Philips
Type: Cermet Preset

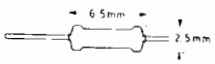
Lin/Log: Lin
P at 70°C: 0.5 W
Tolerance: 20 %



Ω	Ordering Number
10k	5322 100 10113

Lacquered Metal Film
Manufacturer: Philips
Type: MR25

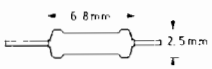
P at 70°C: 0.4 W
Tolerance: 1 %



Ω	Ordering Number
1.21	5322 116 55603
1.47	5322 116 55604
2.15	5322 116 55415
56.2	5322 116 54446
82.5	5322 116 54462
147	5322 116 50766
178	5322 116 54492
196	5322 116 50676
332	5322 116 54513
383	5322 116 54518
464	5322 116 50536
562	5322 116 54009
1 k	5322 116 54549
1.87 k	5322 116 50728
1.96 k	5322 116 55605
2.15 k	5322 116 50767
3.01 k	5322 116 50524
3.32 k	5322 116 54005
4.42 k	5322 116 50556
6.81 k	5322 116 54012
7.5 k	5322 116 54608
10 k	5322 116 54619
13.3 k	5322 116 55276
15.4 k	5322 116 50479
21.5 k	5322 116 50451
46.4 k	5322 116 50557
90.9 k	5322 116 54694
100 k	5322 116 54696
332 k	5322 116 54731

Carbon Film
Manufacturer: Philips
Type: CR25

P at 70°C: 0.33 W
Tolerance up to 1 M: 5 %
Tolerance from 1.2 M: 10 %



Ω	Ordering Number
1M	4822 110 63187
10M	4822 110 63214

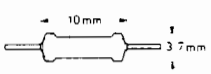
NTC Thermistor
Manufacturer: Elcoma
Type: 2322 642 1

P at 55°C: 0.5 W
Tolerance: 5 %

Ω at 25°C	Ω at 0°C	Ω at 50°C	Ordering Number
4.7 k	15 k	1.5 k	4822 116 30114

Power Metal Film
Manufacturer: Philips
Type: PR37

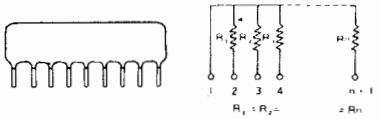
P at 70°C: 1.6 W
Tolerance: 5 %



Ω	Ordering Number
100	4822 116 51098

Standard Networks
Manufacturer: Koa Denko
Type: RK 1/8 B

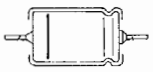
P at 70°C: Rn × 125 mW
Tolerance: 10 %
Max voltage: 200 V



Ω	Length	Ordering Number
1kx6	19.5	5322 111 94015

Aluminium Electrolytic
Manufacturer: Philips
Type 2222 030...033

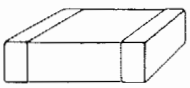
Tolerance: —10+50 %



Capacitance, μF	Voltage, V	Ordering Number
2200	25	4822 124 20788

Ceramic Chip
Manufacturer: Philips
Type 2222 852

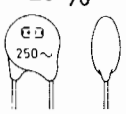
Voltage: 50 V



Capacitance, pF	Tolerance, %	Ordering Number
10000	20	5322 122 34098

Ceramic Disc
Manufacturer: Philips
Type: 2212 660

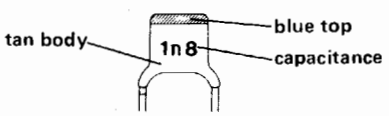
Rated ac voltage: 250 V
Tolerance: 20 %



Capacitance, pF	Ordering Number
1000	4822 122 44019

Miniature Ceramic Plate
Manufacturer: Philips
Type: 2222 640

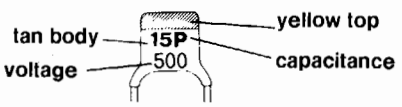
Voltage: 100 V
Tolerance: —20+50 %



Capacitance, pF	Ordering Number
10000	5322 122 34041

Miniature Ceramic Plate
Manufacturer: Philips
Type: 2222 655

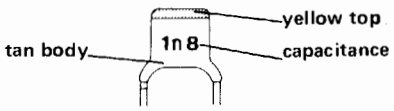
Voltage: 500 V
Tolerance: 10%



Capacitance, pF	Ordering Number
1000	4822 122 31175

Miniature Ceramic Plate
Manufacturer: Philips
Type: 2222 630

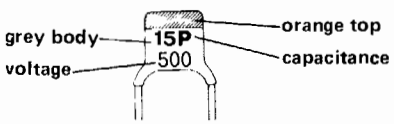
Voltage: 100 V
Tolerance: 10 %



Capacitance, pF	Ordering Number
330	4822 122 31165
560	4822 122 30126
1000	4822 122 31175

Miniature Ceramic Plate
Manufacturer: Philips
Type: 2222 650

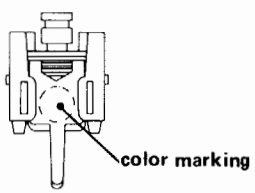
Voltage: 500 V
Tolerance: 2 %



Capacitance, pF	Ordering Number
3.3	4822 122 31217

Film Dielectric Trimmers
Manufacturer: Philips
Type: 2222 809 090

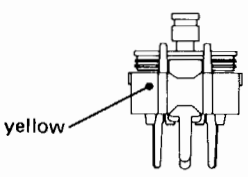
Voltage: 300 V



Capacitance, pF	Ordering Number	Colour Marking
2–9	5322 125 54024	White dot

Film Dielectric Trimmers
Manufacturer: Elcoma
Type: 2222 808

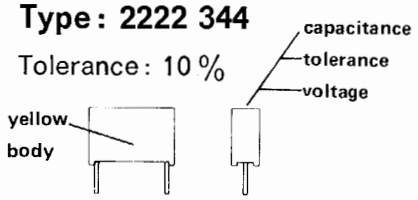
Voltage: 250 V



Capacitance, pF	Ordering Number	Colour Marking
5.5–65	4822 125 50017	Yellow

Metallized Polyester and Polycarbonate Film
Manufacturer: Philips
Type: 2222 344

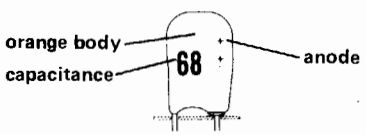
Tolerance: 10 %



Capacitance, nF	Voltage, V	Ordering Number
4.7	630	5322 121 44225
10	400	5322 121 44291
22	250	5322 121 40308
100	100	5322 121 40323

Solid Aluminium Electrolytic
Manufacturer: Philips
Type: 2222 122

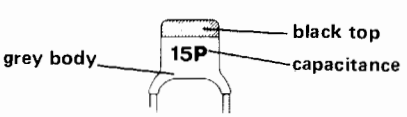
Tolerance: —10+50 %



Capacitance, μF	Voltage, V	Ordering Number
1	25	5322 124 14075
2.2	16	4822 124 10204
6.8	25	5322 124 14081
10	6.3	5322 124 14066
15	6.3	4822 124 20941
15	16	5322 124 14036
68	6.3	5322 124 14079

Miniature Ceramic Plate
Manufacturer: Philips
Type: 2222 638

Voltage: 100 V
Tolerance: 0.25 pF or 2 %



Capacitance, pF	Ordering Number
1.5	4822 122 30105
3.3	4822 122 31041
5.6	4822 122 31047
6.8	4822 122 31049
10	4822 122 31054
12	4822 122 31056
15	4822 122 31058
18	4822 122 31061
22	4822 122 31063
33	4822 122 31067
39	4822 122 31049

Transistors

Type	Ordering number
BD 204	4822 130 41043
BRF 90	5322 130 44179
BF 256A	5322 130 44418
BC 458B	4822 130 40937
BC 558B	5322 130 44197
2N 5770	5322 130 44435
2N 5771	5322 130 44845

Diodes

Type	Ordering number
BAT 43	4822 130 31353
BAV 10	5322 130 30594
BAW 62	5322 130 30613
BA 379	5322 130 34364
HSCH 1001	5322 130 34877
1N 4003	5322 130 30208
BZX 75C1V4	5322 130 34047
HP 5082—2835	5322 130 34283

Integrated circuits

Type	Ordering number
SAB 1009BP	5322 209 86202
SAB 1046P	5322 209 86199
SAA 1062	5322 209 86204
GZF 1201P	5322 209 84722
HEF 4737VP	5322 209 14511
CA 3140E	5322 209 86201
MC 7805CT	5322 209 84454
µA 78S40	5322 209 86513
µA 78L26AC	5322 209 86515
µC 8048	5322 209 14702
µC 10116P	5322 209 85798
LM 324	5322 209 86514
MC 10138P	5322 209 86203
MC 74LS03N	5322 209 85265
MC 74LS74N	5322 209 84986
MC 74LS393	4822 209 80447

IC holders

Description	Ordering number
3 pins	5322 265 64028
14 pins	5322 255 44082
16 pins	5322 255 44111
18 pins	5322 255 44133
28 pins	5322 255 44047
40 pins	5322 255 44217

Sockets and connectors

Item	Description	Ordering number
BU 1	BNC for LF input	5322 267 10004
BU 2	BNC for RF input	5322 267 10004
BU 3	BNC for Ext. std input	5322 267 10004
BU 4	Line voltage input	5322 265 30066
BU 6	2 pole for external battery jack	see section 5 in this manual
BU 7	Battery jack for external battery	see section 5 in this manual
BU 8	10 MHz out for rear panel	5322 290 30236
BU 101	3 pole for display board	5322 265 34105
BU 101	10 pole for PM 9601	5322 267 54195
BU 101	3 pole for TCXO	5322 267 44111
BU 102	9 pole for display board	5322 265 64028
BU 103	5 pole for prescaler board	5322 265 44057
BU 104	10 pole for internal battery	5322 265 64028
BU 105	3 pole for TCXO	5322 265 34105
BU 106	3 pole for IC 112	5322 265 64028
BU 107	5 pole for mains trafo and external battery	5322 265 44057
BU 108	Miniature BNC for Ext. Std.	5322 267 34043
BU 201	3 pole for basic board	5322 267 44111
BU 202	9 pole for basic board	5322 267 54194
BU 203	2 x 17 pole for LCD	5322 267 54193
BU 204	2 x 17 pole for LCD	5322 267 54193
BU 205	Miniature BNC for LF input	5322 267 34043
BU 301	5 pole for basic board	5322 267 44112
BU 302	Miniature BNC for HF input	5322 267 34043

Switches

Item	Description	Ordering number
SK 101	Line	5322 276 14358
SK 102	Measurement time	5322 276 14388
SK 201	Sensitivity	5322 273 44017
DV 101	Jumper for Ext./Int. Std.	5322 263 64007

Inductances

Item	Ordering number
L 101	5322 158 10052
L 102	5322 158 10243
L 301	5322 158 10311
L 302	5322 157 34019
L 303	5322 158 10052

Cabinet

Item	Ordering number
Handle	5322 498 54101
Spring for handle	5322 492 64745
Housing, grey	5322 447 94581
Housing, brown	5322 447 90547

Textplates

Instrument	Ordering number
PM 6667, brown	5322 456 90113
PM 6668, brown	5322 456 90114

Knobs and cover for knobs

Item	Ordering number
Line knob, grey	5322 414 26019
Measurement knob, grey	5322 414 14011
Sensitivity knob, grey	5322 414 34091
Cover, sens knob, grey	5322 414 74015
Line knob, brown	5322 414 20035
Measurement knob, brown	5322 414 20033
Sensitivity knob, brown	5322 414 30044
Cover, sens knob, brown	5322 414 70015

Feet

Item	Ordering number
Rear	5322 462 44434
Front	5322 462 44435

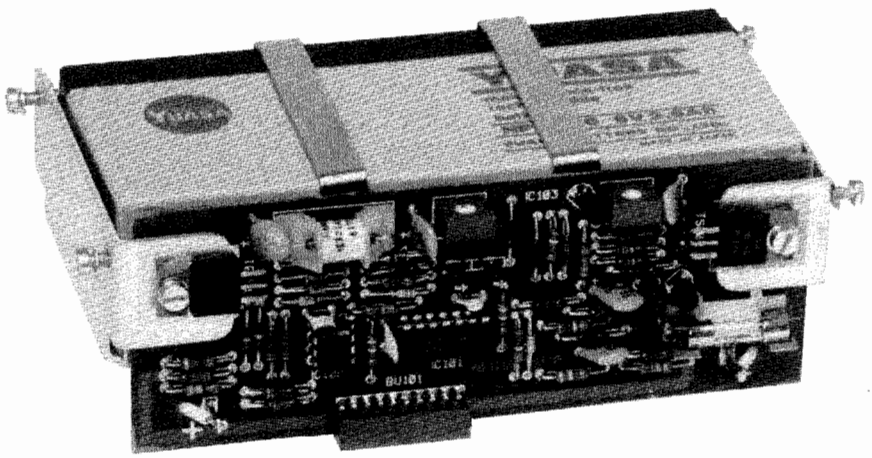
Miscellaneous

Item	Ordering number
Window	5322 459 44002
Display	5322 130 94021
Extension bar	5322 535 94648
Mains transformer	5322 146 14188
Crystal 10 MHz	5322 242 74372
Thermal fuse	4822 252 20007
1.6A fuse	4822 253 20022
Fuse holder	5322 256 34104
TCXO	5322 216 94047

Battery Unit
PM 9601

Instruction Manual

9499 463 01211
850415 First edition



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Operating part

1. Introduction

The PM 9601 is an optional rechargeable battery unit for inside mounting in counters PM 6667 and PM 6668. The unit contains a standard 6 V sealed battery of lead-acid type. This battery can be positioned in any direction and do not need any other maintenance than charging. The unit also contains a charging circuit and a low-battery indication circuit.

There are two versions of the battery unit. The newer one described here has an additional deep-discharge protection circuit that disconnects the battery from the load before the battery is fully discharged. The life-time of the battery is thereby increased. The new version can be identified by the number on the PC board 4031 100 38370.

2. Characteristics

Performance characteristics

Properties expressed in numerical values with stated tolerances are guaranteed by the Philips organisation in your country. Specified nontolerance numerical values indicate those that could be expected from the mean of a range of identical units.

Electrical characteristics

Input voltage:	7.3...15 VDC at full load.
Battery voltage:	6 V nominal.
Fuse:	1.6 A fast action.
Charge current:	Limited at 560 ± 30 mA.
Charging time: (in ST BY)	5 h from min. level to appr. 70 % capacity, 10 h from min. level to 90 % of full capacity.
Battery low indication	A TTL-low signal, when the battery voltage drops below 5.7 V, the display indicates "LO BAT" and 10...15 min of operation is left before recharging.
Deep discharge protection:	When the battery voltage drops below 5.5 V the battery is disconnected from the load.
Capacity:	6 hours operation in PM 6667 and 4 hours in PM 6668.
Output voltage:	5.0 ± 0.2 V.
Over voltage protection:	6.9 V.
Over current protection:	0.8 ± 0.2 A at short circuit

Enviromental characteristics

Temperature:	Operating 0 °C...+45 °C.
Barometric pressure:	Storage 15.2 kN/m^2 (15000 m)
	Operating 53.3 kN/m^2 (5000 m)
Humidity:	10...90 %RH (26 °C dew point)
Mechanical:	Vibration test acc. to IEC68Fc
	Bump test acc. to IEC68Eb
	Handling test acc. to IEC68Ec
	Transport test acc. to NLN-L88
	Dimensions: 140x95x50 mm
	Weight approx: 0.75 kg

Accessory

- One screening plate.

3. Installation

The battery unit includes screws to secure the unit inside the counter. See figures 3.1 and 3.2 and proceed as follows:

- Disconnect the counter from the line.
- Set the mains switch to STBY
- Remove the cover of the counter.
- Remove the +5 V regulator IC112, see fig 3.1.
- Unscrew the four fixing screws on PM 9601 sufficient to allow the mounting.

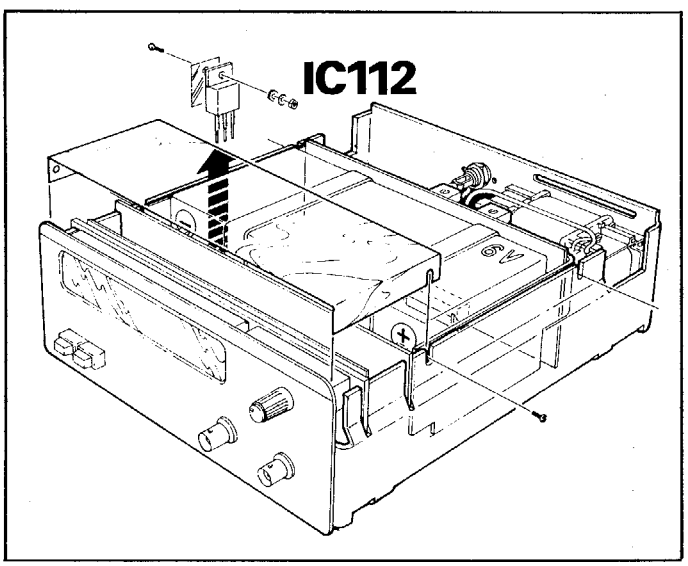


Fig 3.1 Mounting the battery unit.

- Place the battery unit inside the counter with the PC board facing the rear panel. Make sure that the counter pin connector fits properly into the battery unit's socket connector. Be careful, to avoid damaging the PCBpattern. In the same time, the four fixing screws must fit into their slots in the side pieces of the counter.

- Fasten the battery unit to side pieces of the counter with the two rear screws.
- Set the mains switch to position ON but do not connect the power cord.
- Check that all segments, decimal points and sorts are displayed for a short moment, after that only zeros shall be displayed when no signal source is connected.
- Check that the display do not indicate "LO BAT"

"LO BAT" indicates a too low battery voltage. See chapter Operating.

- Release the power switch.
- Fasten the new screening plate with the two front screws on the battery unit, see also fig. 3.1. The old screening plate shall not be used.

- Refit the cover on the counter.
- Mark the square "BATTERY" on the label on the counter's rear panel to indicate that this option is installed.
- When the installation is completed, connect the counter to the mains and allow it to charge the battery for at least 10 hours.

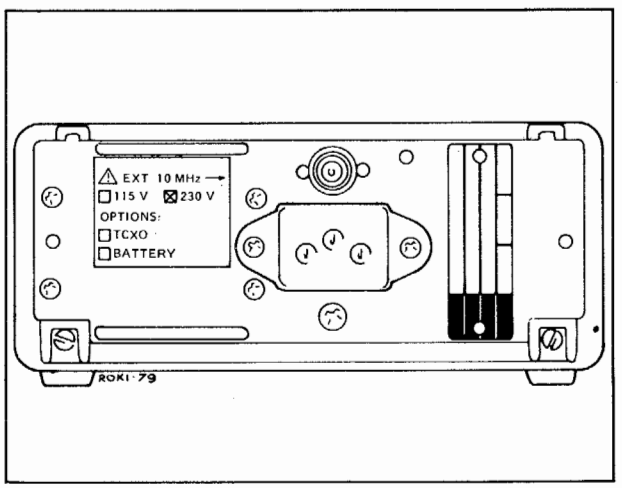


Fig. 2 Marking the square "BATTERY" on the label.

4. Operating

NOTE: When the counter has not been used for some time, always start the operation by charging the battery. The battery will automatically be charged if power is connected to the counter.

Line operation

When the counter has got a battery unit, operating is the same as normal in most aspects. Charging the battery is done automaticly as long as the mains voltage is connected to the counter. The battery is charged no matter how the power switch of the counter is set.

External DC operation

The counter can after modification also be supplied from an external DC-system. A 12 V battery is recommended as axternal DC source but as long as the DC-level is above 9 V a built in optional battery will be charged. Note that the highest allowed DC input voltage is 15 V.

Internal battery operation

For internal battery operation the power switch shall be set to ON and no mains voltage connected. Switching from external to internal supply mode and vice versa, is done without interruption.

Fuse

The battery unit is provided with a 1.6 A fast action fuse, located on the printed-circuit board.

Capacity

Capacity is the total energy available from a fully charged battery, normaly expressed in ampere-hours. At normal room temperature, the counter can work on the battery for a minimum of 4 hours. When low-battery voltage is indicated, the counter can operate for another 10 to 15 minutes before charging is necessary.

The capacity of rechargable batteries degrades when the batteries are not used frequently. The degraded capacity of batteries after having been inoperative, can be upgraded again by cycling the batteries some times, i.e. fully charging and discharging the batteries.

Charging

When the counter display indicates low battery voltage, or when the battery unit has been stored for more than three months, the battery should be charged as follows:

- Connect the counter to the line voltage.
- Set the counter power switch to STBY.
- Charge for a minimum of 8 hours. The battery is protected against overcharge, so an extended charging time will cause no damage.

Storing

Do not store discharged batteries!

When the counter is out of use, set the power switch to position STBY. Keep the counter connected to the line voltage. In this way the batteries will be kept fully charged and ready for use.

If the counter cannot be left connected to the line voltage, or when the battery unit is stored outside the counter, recharging for 5 to 10 hours every 3 months is recommended. If longer storage periods cannot be avoided, store the unit in a cool, dry place.

Note: 1. Permanent use and storage at high temperatures shortens the life of the battery.

2. +40 °C as well as charging above +35 °C should be avoided.

3. be charged to at least 75 % of its full capacity.

Service part

These service instructions are for use by qualified personnel only. To reduce the risk of electrical shock do not perform any service other than that specified in the operating instructions unless you are fully qualified to do so.

5. Functional description

General

The circuit diagram consist of:
- The prestabilizer and charging circuit IC102, TS101 and IC101:7 with their associated components.
- The low-voltage warning circuit, IC101:8.
- The deep discharge protection circuit IC101:14 TS103 and RE101.
- The +5 V output voltage stabilizer with over current protection IC101:1 and TS102.

When the counter is connected to the line voltage, a 7.3...15 V unregulated DC voltage is fed to BU101:3,10. When the switch SK101 is set to position ON, the +5 V output voltage of PM 9601 feeds the counter. The battery is continuously charged. The control circuit gives warning for low battery voltage and disconnects the load to avoid a too deep discharge of the battery.

Charging circuit

The voltage on BU101:3,10 is applied to the charge regulator IC101:5,6,7 and TS101. IC102 senses the input current via the resistive network R102, R103 and R105...R108. IC102 controls the charge current by changing the sense-voltage to IC101. The charge voltage is sensed by R104, R109...R111 and R114. R109 and R104 are used for temperature compensation, and the potentiometer R114 sets the charge voltage. Diode GR105 prevents reverse leakage current from discharging the battery.

When the power switch on the counter is set to STBY the charging current is about 0.5 A.

Low voltage warning circuit

The low voltage warning circuit includes IC101:8, which works as a comparator. A stabilized 2 V reference voltage is supplied from IC103 via R117 to IC101:9. This voltage is compared with the battery voltage via R123 and R124. The output of IC101:8 is fed via BU101:7 to the "LO BAT" input of the counter.

Deep discharge protection circuit

The voltage divider R123, R124,127 and the voltage reference IC103 determines the cut off level for the battery. When the battery voltage drops to 5.5 V, IC101:14 disconnects the battery from the load by switching off RE101 via TS103.

Battery mode ON/OFF

From the battery, 6V is connected via BU101:1, SK101 in the counter to BU101:9 and via R131 to C108. This turns TS103 and RE101 on which gives supply to the IC:s and the voltage divider R123, 124, 127.

When SK101 is switched off, TS104 starts conducting due to R133, R130 will reduce the level on IC101:12, turning RE101 off.

6. Adjustment

The parameters that might need adjustment, e.g. after replacement of components are the internal reference voltage and the charging voltage.

The reference voltage available on BU101:5 shall be adjusted to 2.000 ± 0.005 V with R117.

The voltage limit of the prestabilizer is temperature compensated via R104. Before an adjustment is made the ambient temperature has to be measured and no soldering is allowed close to the NTC resistor.

For adjustment, proceed as follows:

- Remove the battery unit's fuse.
- Connect the counter to the line voltage.
- Set the mains switch to STBY.
- Connect a digital voltmeter to the plus pole of the battery and the earth terminal of the fuse holder.
- Adjust R114 to 6.90 ± 0.002 V at a room temperature of 19...22 °C or 6.82 ± 0.002 V at a room temperature of 23...26 °C.

The current limit of the prestabilizer / charging circuit shall be 560 ± 30 mA. The limit is set with R115. If R115 has been changed the reference voltage must be readjusted.

When replacing components on the circuit board, always disconnect the counter from the line voltage and remove the battery unit fuse.

7. Replacement of batteries

If the battery unit is mounted in the counter, it must be removed for replacement of batteries. Proceed as follows:

- Remove the fuse.
- Remove the two screws on the battery holders.
- Detach the two cables with fast-on connectors and remove the battery.
- Observe the correct polarity when fitting the new battery.
- Fix the new battery with the holders, connect it and replace the fuse.

The battery, which are of standard type is available from a number of manufacturers. The following list includes some of the battery types that can be used.

Manufacturer	Made in	Type	Capacity
Sonnenschein*	W-Germany	3GX3S	3.0 Ah
Varta*	W-Germany	AccuPb30704063	3.0 Ah
Yuasa*	Japan	NP2.6-6	2.6 Ah
Kono	Japan	6-26K	2.6 Ah
Gold Gelyte	USA	Pb 626-1	2.6 Ah
Elpower	USA	Ep 626-1	2.6 Ah

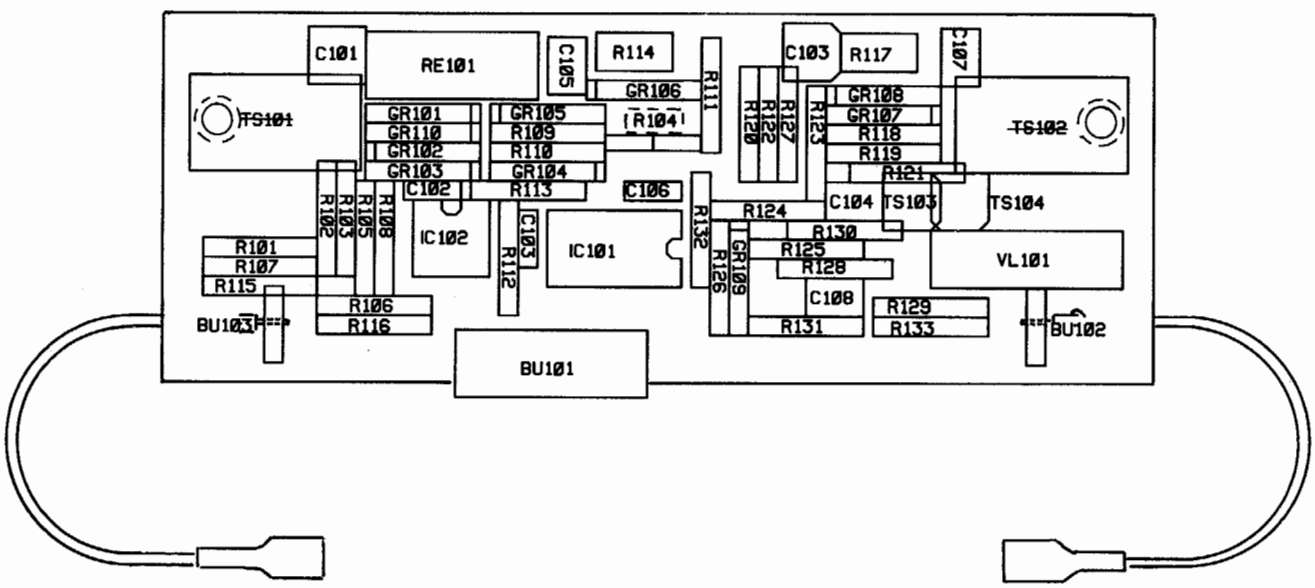
* Recommended

8. Spare part list

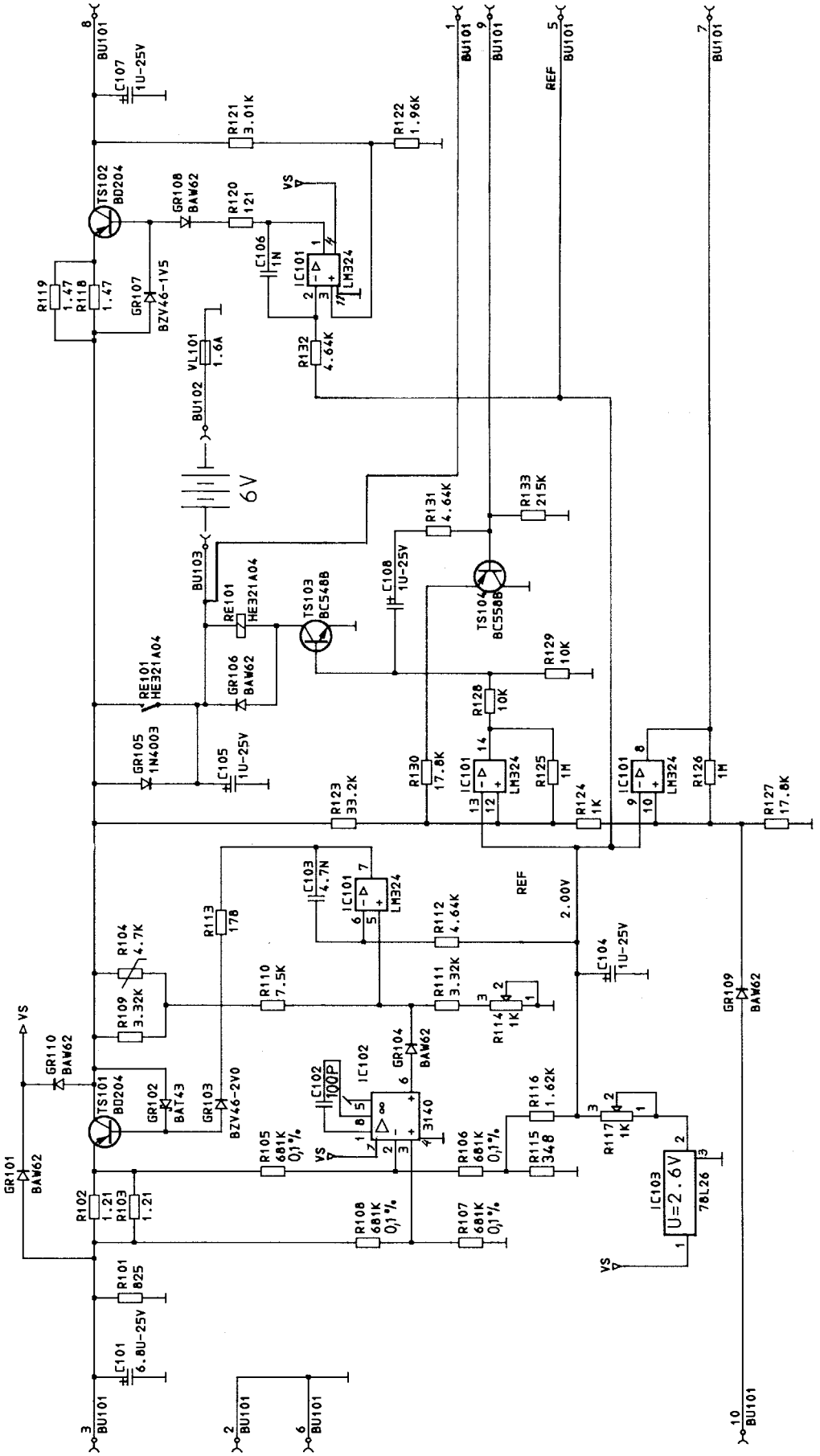
Item	Order number	Description	Specification		
BU101	5322 267 54195	Connetor			
C101	5322 124 14081	Capacitor solid alu	6.8µF	20%	25V
C102	4822 122 31316	Capacitor ceramic	100pF	2%	100V
C103	4822 122 31125	Capacitor ceramic	4,7nF	80%	63V
C104...105	4822 124 21457	Capacitor solid alu	1µF	10%	25V
C106	4822 122 30027	Capacitor ceramic	1nF	10%	100V
C107...108	4822 124 21457	Capacitor solid alu	1µF	10%	25V
GR101	4822 130 30613	Diode,	BAW62/75		
GR102	4822 130 31353	Diode,	BAT43/30		
GR103	4822 130 31248	Diode, reference	BZV46/2V0		
GR104	4822 130 30613	Diode,	BAW62/75		
GR105	4822 130 31174	Diode,	1N4003/200		
GR106	4822 130 30613	Diode,	BAW62/75		
GR107	4822 130 34865	Diode, reference	BZV46/1V5		
GR108...110	4822 130 30613	Diode,	BAW62/75		
IC101	5322 209 86514	Integrated circuit	LM324		
IC102	5322 209 86201	Integrated circuit	CA3140		
IC103	5322 209 86515	Integrated circuit	UA78L26AWC		
RE101	5322 280 20144	Relay, reed	HE321A0400		
R101	5322 116 54541	Resistor metal film	825ohm	1%	0.4W
R102, 103	5322 116 55603	Resistor metal film	1.21ohm	1%	0.4W
R104	not used				
R105...108	5322 116 53066	Resistor metal film	681k	0.1%	1/8W
R109	4822 116 51247	Resistor metal film	3.32k	0.5%	0.5W
R110	5322 116 54608	Resistor metal film	7.5k	1%	0.4W
R110-2	5322 116 30239	Resistor NTC	4.7k	5%	0.5W
R111	4822 116 51247	Resistor metal film	3.32k	0.5%	0.4W
R112	5322 116 50484	Resistor metal film	4.64k	1%	0.4W
R113	5322 116 54492	Resistor metal film	178ohm	1%	0.4W
R114	5322 101 14299	Potentiometer trim	1k	10%	
R115	5322 116 54515	Resistor metal film	348ohm	1%	0.4W
R116	5322 116 55359	Resistor metal film	1.62k	0.5%	0.4W
R117	5322 101 14299	Potentiometer trim	1k	10%	
R118, 119	5322 116 55604	Resistor metal film	1.47ohm	1%	
R120	5322 116 54426	Resistor metal film	121ohm	1%	0.4W
R121	4822 116 51246	Resistor metal film	3.01k	0.5%	0.4W
R122	5322 116 54571	Resistor metal film	1.96k	1%	0.4W
R123	4822 116 51259	Resistor metal film	33.2k	0.5%	0.4W
R124	4822 116 51235	Resistor metal film	1k	0.5%	0.4W
R125...126	5322 116 55535	Resistor metal film	1M	1%	0.4W

Item	Order number	Description	Specification		
R127	5322 116 54637	Resistor metal film	17.8k	1%	0.4W
R128...129	4822 116 51253	Resistor metal film	10k	0.5%	0.4W
R130	5322 116 54637	Resistor metal film	17.8k	1%	0.4W
R131...132	5322 116 50484	Resistor metal film	4.64k	1%	0.4W
R133	5322 116 54728	Resistor metal film	215k	1%	0.4W
TS101..102	5322 130 44324	Transistor	BD204		
TS103	4822 130 40948	Transistor	BC548B		
TS104	4822 130 44197	Transistor	BC558B		
VL101	5322 256 34104	Holder, fuse			
VL101	4822 253 20022	Fuse 1.6A	5 x 20mm		

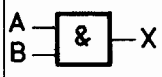
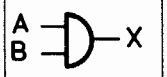
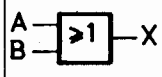
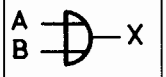
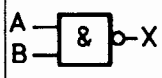
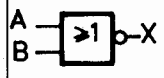
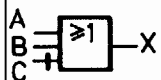
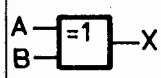
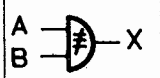
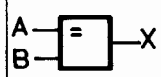
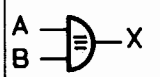
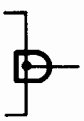
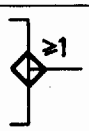
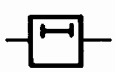
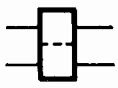
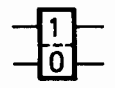
9. Component layout



10. Circuit diagram



Standard symbols for logic elements

Circuit	I.E.C.	DIN norm 40700	American standard	Boolean function
AND				$X = AB$
OR				$X = A + B$
NAND				$X = \overline{AB}$
NOR				$X = \overline{A + B}$
NAND with one inverting input				$X = \overline{\overline{A}B}$
NOR with one inverting input				$X = \overline{\overline{A} + B}$
INHIBIT GATE				$X = (A + B)\overline{C}$
EXCLUSIVE OR				$X = A\overline{B} + \overline{A}B$
COM-PARATOR				$X = AB + \overline{A}\overline{B}$
Distributed AND				
Distributed OR				
DELAY				
FLIP-FLOP				

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