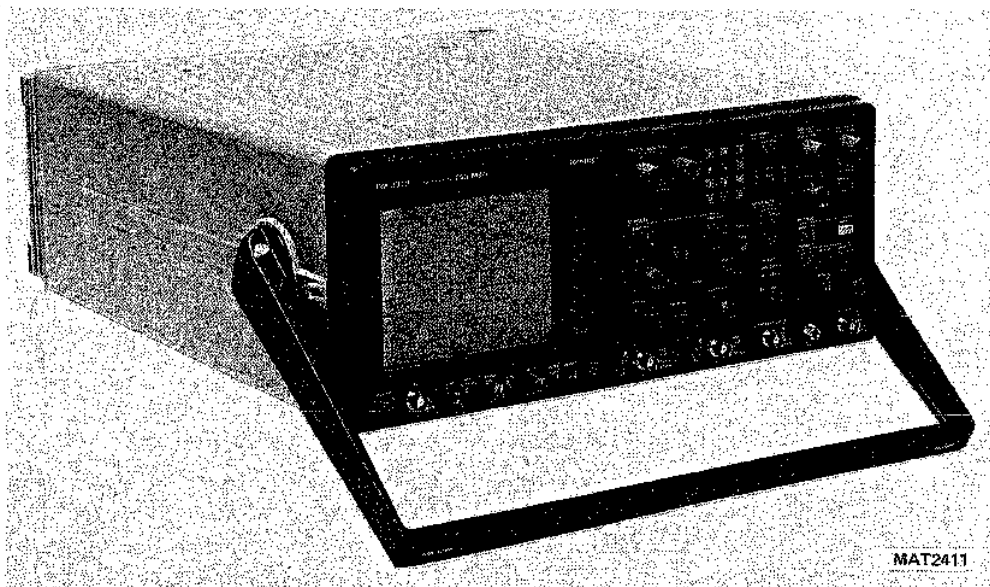


# 250 MS/s Dual Channel Digital Storage Oscilloscope PM3320

## Service Manual

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**WARNING:** These servicing instructions are for use by qualified personnel only. To avoid electric shock do not perform any servicing other than that contained in the Operating Instructions unless you are fully qualified to do so.



**Industrial &  
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## 2.0 INTRODUCTION

This compact dual channel digital storage oscilloscope features an extensive sampling rate of 250 Megasamples/s with a vertical bandwidth of 200 MHz and a vertical resolution of 10 bit. An outstanding feature is the AUTO-SET pushbutton facility, which automatically sets various controls of the instrument to suit the input signal value. In this way, optimum ease of operation is obtained as the input signal immediately presents a correct, stable display on the bright C.R.T. screen.

The brightness is independent of the time base settings. The M68000 microprocessor gives a wide choice of measurement and display possibilities, which can be selected via the ergonomic designed front panel.

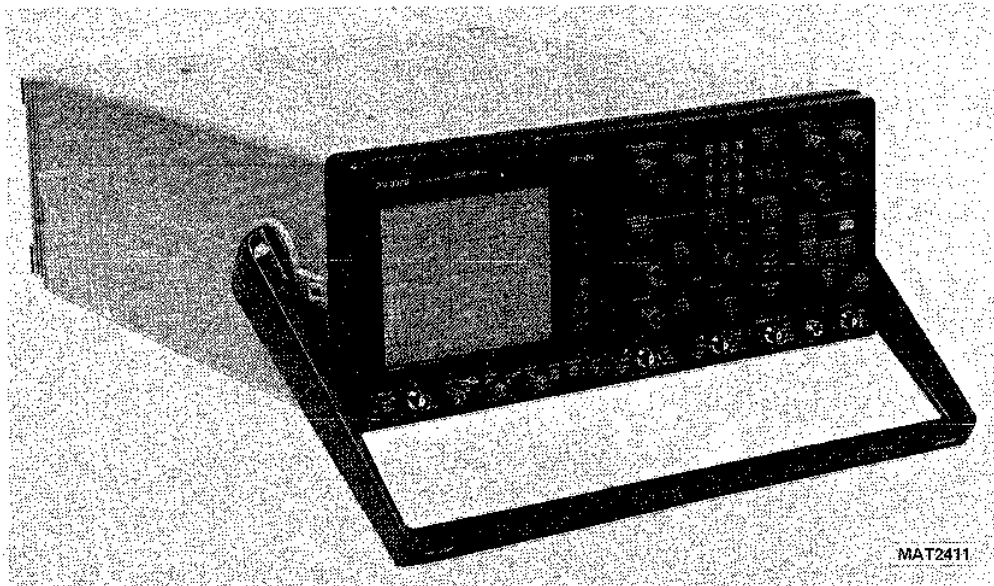


Figure 2.1 250 Megasamples/s digital storage oscilloscope.

The oscilloscope is provided with integrated circuits (including thinfilm circuits), which guarantee highly-stable operation.

Furthermore, connection to the local mains is simplified by a tapless switched-mode power supply that covers most voltage ranges in use: 90 V...264 V a.c.

All these features make this oscilloscope suitable for a wide range of measuring applications.

## 3.0 CHARACTERISTICS

## General

This instrument has been designed and tested in accordance with IEC publication 348 for Class I instruments.

This specification is valid after the instrument has warmed up for 30 minutes.

Properties expressed in numerical values with tolerances stated, are guaranteed by the manufacturer.

Numerical values without tolerances are typical and represent the characteristics of an average instrument.

Within 5 minutes after switching on, the temperature difference inside the instrument has reached 70 percent of its end value.

	CHARACTERISTIC	SPECIFICATION	ADDITIONAL INFORMATION
3.1	CATHODE RAY TUBE		
3.1.1	Type	Philips D18-190GH/129	180 mm rectangular single beam tube.
3.1.2	Usefull screen area (h. x w.)	100 mm x 120 mm	For graticule see 3.1.7.
3.1.3	Screen type	GH (P31)	
3.1.4	Total acceleration voltage	16 kV	
3.1.5	Spot size	0,3 mm	Tube only.
3.1.6	Maximum trace distortion		Deviation from straight line.
	-@ screen periphery 1 mm		Outside central 80 mm (vert.) x 100 mm (hor.).
3.1.7	Graticule	Internal, fixed	
	-Illumination	Continuously variable	
	-Size (h. x w.)	80 mm x 100 mm	Centered @ 50 mm from top of CRT screen (hor.) and @ 50 mm from left edge of CRT screen (vert.).
	-Engravings		
	division lines	@ 10 mm	Horizontal and vertical.
	2 mm tick marks	@ 2 mm	On vertical and horizontal central axes.
	0.5 mm tick marks	@ 2 mm	On horizontal lines #2,3,4,6,7,8.
	dots	@ 2 mm	On dotted lines @ 1,5 div and 6,5 div from top of graticule.
	percentages	100-90-10-0 %	To facilitate rise and fall time measurements.
3.1.8	Orthogonality		Measured @ centre of screen.
		$90 \pm 0,5^\circ$	(Angle between X and Y axes, when traces are written in X- and Y direction alternately).

CHARACTERISTIC	SPECIFICATION	ADDITIONAL INFORMATION
3.1.9	Intensity	Blank to max. intens. Separate front panel controls for trace and text.
3.1.10	Focus	Manually set Common screwdriver control on front for trace and text.
3.1.11	Trace rotation	Screw driver control on front; direction of screw driver rotation same as direction of trace rotation.
	-Minimum range	14° Either X or Y trace can be aligned with graticule, when environmental magnetic field is within 0,1 mT.
3.2	SIGNAL ACQUISITION	
3.2.1	Sampling type	
	-@ 200 ns/div... 360 s/div:	Real time
	-@ 5 ns/div... 100 ns/div:	Equivalent time
		Random sampling.
3.2.2	Maximum sampling rate	Sampling rate depends on time/div setting.
	-Real time:	250 megasamples/s
	-Equivalent time:	10 gigasamples/s
	-Ext. clock	50 kilosamples/s
		Repetitive only. Max. aperture uncertainty of 10 us.
3.2.3	Vertical (=voltage) resolution	10 bits (= 0,1 % of full range).

CHARACTERISTIC	SPECIFICATION	ADDITIONAL INFORMATION
3.2.4	Horizontal (=time) resolution	
	-In single Ch. or added Ch. acquisition	
	@ 1 ms/div... 5 s/div	4096 samp./acquisition 1 Sample = 0,025 % of full record.
	@ 5 ns/div... 500 us/div	512 samp./acquisition 1 Sample = 0,2 % of full record.
	-In dual channel acquisition	
	@ 1 ms/div... 5 s/div	2048 samp./acquisition 1 Sample = 0,05 % of full record.
	@ 5 ns/div... 500 us/div	512 samp./acquisition 1 Sample = 0,2 % of full record.
3.2.5	Record length	10,2 x time/div Display in unmagnified position.
3.2.6	Acquisition time	
	-Real time	10,2 x time/div
	5 s/div ...	+ 1 ms/div
	1 ms/div	}
	500 us/div ...	+ 10 ms
	200 ns/div	}
	-Equivalent time	}
	@ 5ns/div	2 s
	@ 100 ns/div	10 ms
		} After this time there is
		} a 99 % probability of
		} all dots being updated
		} to the new acquisition.
3.2.7	Sources	
	Channel A	} Both channels can be
	Channel B	} inverted before acquisition.
3.2.8	Acquisition modes	
	1 channel only	Full memory available for 1 channel.
	2 channels	Simultaneously sampled; 2 channels share memory.
	Ch.A and ch.B added	Full memory available for added channels.
	Average	Combined with 1 channel only, 2 channels or ch. A and ch. B added.
	MIN / MAX	Combined with 1 channel only, 2 channels or ch. A and ch. B added.

CHARACTERISTIC	SPECIFICATION	ADDITIONAL INFORMATION	
3.2.9	Maximum time difference	200 ps	Two 2 channels are sampled simultaneously.
3.3	CHANNELS A AND B		
3.3.1	Input connector	BNC with probe read-out	Probe read-out causes instrument to change V/div indication, input impedance and attenuator setting according to probe (when fitted with a probe indicator).
3.3.2	Input impedance (In high Z position)		For frequency > 1 MHz see Fig. 3.1.
	-R parallel	1 M Ohm $\pm$ 1 %	}In DC position of input }coupling. In AC position }of input coupling.: 18 nF }in series with R par. & }C par. }In 0 position of input }coupling: R par. = Capacitance difference between channel A, channel B and/or trigger input.
	-C parallel	14 pF	
	-Maximum input capacitance difference	1,5 pF	
3.3.3	Input impedance (in 50 ohm position)		
	-R parallel	50 Ohm $\pm$ 1 %	In DC, AC and 0 position of input coupling.
	-VSWR (typical)	1,2:1	@ 200 MHz; in AC and DC pos. of input coupling.
3.3.4	Input coupling	a.c. d.c. 0	In 0 position: channel input disconnected from BNC and connected to ground.
3.3.5	Max. input voltage		Instrument should be properly grounded through the protective-ground conductor of the power cord.
	-In high Z position (d.c. + a.c. peak)	300 V	Up to 1 MHz; for freq. > 1 MHz see Fig. 3.2.
	-In 50 ohm position		} Max. 50 mJ during any } 100 ms interval. }
	d.c.	5 V	
	a.c. (r.m.s.)	5 V	
	a.c. (peak)	50 V	



	CHARACTERISTIC	SPECIFICATION	ADDITIONAL INFORMATION
3.3.6	Deflection coefficient		
	-Steps	5 mV/div...5 V/div	In a 1-2-5 sequence of 10 steps.
	-Vernier ratio	1:2,5	Continuously variable between steps.
	Read out accuracy	<u>+ 15 %</u>	
	-Error limit (Ambient:15..35°C)		Add 3 % for ambient: 0...50°C.
	overall	<u>+ 2 %</u>	}
	up to memory	<u>+ 1 %</u>	}Vernier in 0 position.
	additional error	<u>+ 15 %</u>	} Vernier not in 0 position.
3.3.7	Dynamic range	10 div	
3.3.8	D.c. offset control		Related to BNC input.
	-Range ( <u>+ 5%</u> )		Input voltage within the limits of 3.3.5.
	Att. @ 5 mV/div ...20 mV/div	<u>+ 5 V</u>	}In AUTO OFF-SET, the }offset is automatically }controlled such, that }average d.c. level of }signal is presented at }screen centre ( <u>+ }2 div), provided signal }is within offset range. }Shift is set to zero } (mid) level.</u>
	Att. @ 50 mV/div ...0,2 V/div	<u>+ 50 V</u>	
	Att. @ 0,5 V/div ...5 V/div	<u>+ 300 V</u>	
	-Resolution ( <u>+ 5%</u> )		
	Att. @ 5 mV/div ...20 mV/div	5 mV	
	Att. @ 50 mV/div ...0,2 V/div	50 mV	
	Att. @ 0,5 V/div ...5 V/div	0,5 V	
3.3.9	Shift range	<u>+ 5 div</u>	From screen centre.



CHARACTERISTIC	SPECIFICATION	ADDITIONAL INFORMATION
3.3.10	Frequency response (in 50 ohm position)	Z source: 50 Ohm
	-Lower transition point of BW	
	Input coupling in d.c. DC position	
	Input coupling in $\leq 10$ Hz AC position	
	-Upper transition $\geq 200$ MHz (-3 dB) point of BW (Ambient: 15..35°C)	Deviation max. 30 MHz for ambient: 0...50°C.
3.3.11	Freq. resp. (In hi.Z pos. through probe)	Z source = 25 Ohm. Probe according to 3.19.
	-Lower transition point of BW	
	Input coupling in d.c. DC position	
	Input coupling in $\leq 1$ Hz AC position	
	-Upper transition $\geq 200$ MHz (-3 dB) point of BW (Ambient: 15..35°C)	Deviation max. 30 MHz for ambient: 0...50°C.
3.3.12	Bandwidth limiter	
	-Starting point of 20 MHz (-3 dB) HF rejection	
	-Slope 6 dB/octave	
3.3.13	Pulse response ( in 50 Ohm position) (exclusive first dot after transient)	Z source = 50 Ohm; measured over central 6 div.
	-Rise time $\leq 1,75$ ns (Ambient: 15..35°C)	(Calculated from bandwidth $\times$ Rise time = 0,35). Add max. 0,25 ns for ambient: 0...50°C.
	-Pulse aberrations	Tested with ca 1 ns rise time pulse.
	Overshoot }	
	Ringing } < 6%	During first 10 ns after transient.

CHARACTERISTIC	SPECIFICATION	ADDITIONAL INFORMATION
3.3.14	Pulse resp. (in hi.Z pos. through probe) (exclusive first dot after transient)	Z source: = 50 Ohm; measured over central 6 div. Probe according to 3.19.
	-Rise time (Ambient: 15..35°C)	(Calculated from bandwidth x Rise Time = 0,35). Add max. 0,25 ns for ambient: 0...50°C.
	-Pulse aberrations	Tested with ca 1 ns rise time pulse.
	Overshoot	} < 6 % }
	Ringling	} }
3.3.15	Max. base line instability	
	-Jump (Ambient 15..35°C):	Add 25 % for ambient: 0...50°C.
	when switching to added mode	0,3 div
	when switching to MIN / MAX mode	0,5 div
	between any V/div positions	0,15 div
	when actuating inverter switch	0,3 div
	between AC, 0 and DC position	0,1 div
	when rotating vernier	0,6 div
	between any time/div positions	0,6 div
	when switching to magn. x5	0,5 div
	-Drift	0,1 div/h }
	-Temperature coefficient	} Measured in 20 mV/div } position. }

CHARACTERISTIC	SPECIFICATION	ADDITIONAL INFORMATION
3.3.16	Common mode rejection ratio	Both channels @ same attenuator setting; vernier for V/div setting adjusted for optimal CMMR at 10 kHz measured with max. 8 div input signal on each channel, (+ 4 div around zero).
	-@ 1 MHz	100:1
	-@ 50 MHz	20:1
3.3.17	MIN / MAX function	Time base setting 5 us/div ... 360 s/div. Average switched off.
	-Accuracy > 50 %	@ pulse > 3 ns
	-Reset time	20 ns
3.3.18	Average	Average formula after the first front change (MIN / MAX switched off). $So(n) = So(n-1) + \frac{Sn - So(n-1)}{C}$
	Constant is max.	64x 32 x or off In ROLL mode.
3.3.19	Cross talk (according to IEC 351)	<-30 dB @ 100 MHz <-50 dB @ 2 MHz

	CHARACTERISTIC	SPECIFICATION	ADDITIONAL INFORMATION
3.4	TIME BASE		
3.4.1	Modes	Recurrent Single shot Single scan Multiple shot Multiple scan Roll	Up to 4 shots. Up to 4 scans. Can be stopped manually or by trigger.
3.4.2	Time coefficients		
	-In recurrent	5 ns/div...5 s/div	
	-In single scan and multiple scan	5 ns/div...100 ns/div	
	-In single shot and multiple shot	200 ns/div...5 s/div	
	-In roll mode	50 ms/div...360 s/div	
	-With EXT CLOCK	Depending on clock frequency	Input via EXT CLOCK, every clock pulse a sample is taken, so for single channel 4k samples are stored and for dual channel 2 times 2k samples.
	-Error limit (Ambient 15..35 °C)		
	In equivalent time mode	+ 4 %	Add 2 % for ambient: 0...50°C.
	In real time mode	+ 1 %	Add 0,5 % for ambient: 0...50°C.
3.5	TRIGGER		
3.5.1	Sources		
	-Signal trigger	Channel A Channel B EXT LINE	
	-Events	EXT	Serves as delay to signal trigger.
3.5.2	Input connectors	BNC	

CHARACTERISTIC	SPECIFICATION	ADDITIONAL INFORMATION
3.5.3	Input impedance of EXT trigger inputs	
	-R parallel	1 M Ohm $\pm$ 1 %
	-C parallel	14 pF
	-Max. input capacitance difference	1,5 pF
		In DC position of input coupling.
		Difference between channel A, channel B and EXT trigger input.
3.5.4	Coupling	
	-Signal trigger	d.c. a.c. LF rejected HF rejected Auto level TVF
		According to CCIR.
	-Clock & events trigger level	TTL ECL Through variable level
		Adjustable via menu "trigger coupling" - events.
3.5.5	Max. input voltage (d.c. + a.c. peak)	
		Instrument should be pro- perly earthed through the protective-earth conductor of the power cord.
	-Clock trigger	300 V
3.5.6	Signal trigger sensitivity (Ambient 15..35°C)	
		Add 10 % for ambient: 0...50°C.
	-Channel A or B	
	@ 300 MHz	$\leq$ 3 div
	@ 200 MHz	$\leq$ 1 div
	@ 30 MHz	$\leq$ 0,5 div
	-EXT	
	@ 300 MHz	$\leq$ 300 mV
	@ 200 MHz	$\leq$ 0,1 V
	@ 30 MHz	$\leq$ 0,05 V
	-EXT/10	
	@ 300 MHz	$\leq$ 3 V
	@ 200 MHz	$\leq$ 1 V
	@ 30 MHz	$\leq$ 0,5 V



CHARACTERISTIC	SPECIFICATION	ADDITIONAL INFORMATION
3.5.7 Slope selection	Positive going Negative going Dual slope	Level adjustable; not effective in random sampling and TVF.
3.5.8 Signal level control range		
-Channel A or B	+ 8 div	}
-EXT	+ 0,8 V	}When not in AUTO position }of trigger mode.
-EXT/10	+ 8 V	}
-Any source	Related to peak value	}In AUTO position of trigger mode.
3.5.9 Frequency response		Trigger BW not affected by bandwidth limiter.
-Lower transition point of BW		Ch. A and Ch. B coupling cascaded with trig. coupl.
Trigger coupling in DC position	d.c.	
Trigger coupling in AC position	10 Hz (- 3dB)	
Trigger coupling in LF reject pos.	50 kHz (- 3 dB)	
-Higher transition point of BW	see also 3.5.6.	
Trigger coupling in HF reject pos.	50 kHz (-3 dB)	
3.5.10 Trigger delay		
-Range	-10...9999 div	}can also be indicated in }time.
@ 5 ns/div ...		}
100 ns/div	-10...500 div	}
-Number of events	1...9999	
Max. frequency	5 MHz	
-Accuracy	+ 1 %	
@ 5 ns/div ...	+ 4 %	
100 ns/div		

	CHARACTERISTIC	SPECIFICATION	ADDITIONAL INFORMATION
3.6	MEMORY		
3.6.1	Memory size		
	-Registers	4	Registers #0, #1, #2, #3
	-Register depth	4096 words	
	-Wordlength	10 bits	
3.6.2	Functions		
		Clear	Register #0 is cleared, incl. pre-trigger memory and blanked if DOTS is selected.
		Save	Contents of register #0 is saved in selected register (#1, #2 or #3).
		Write	Acquired signal is written into register #0.
		Lock	Memory system is locked, including register #0.

	CHARACTERISTIC	SPECIFICATION	ADDITIONAL INFORMATION
3.7	DISPLAY		
3.7.1	Sources	Register #0 Register #1 Register #2 Register #3	} }In any combination. } }
3.7.2	Display expansion		
	-Horizontal		
	Steps:	1x...64x 1x...8x	Y versus t A versus B
	Vernier ratio	1:2,2	Continuously variable between steps. Recalculated value is displayed with an accuracy of <u>+ 5 %</u> .
	-Vertical		
	Steps:	0.2x, 1x and 5x	Both in Y versus t and Y versus X modes.
3.7.3	Display manipulations	Smooth  Dot join  Invert	Reduces noise by adding a filter in the display section, that is only effective at time base 500 us/div ... 360 s/div.  Linearly interpolated between measured dots.  Alle registers can be inverted.
3.7.4	Position range		All channels can be positioned independently.
	-Horizontal	<u>+ 5 div</u>	From screen centre.
	-Vertical	<u>+ 5 div</u>	From screen centre.



CHARACTERISTIC	SPECIFICATION	ADDITIONAL INFORMATION
3.8	SETTING MEMORY	
3.8.1	Memory size	Max. 77 front settings
3.8.2	Functions	
	Save	Actual settings are stored in memory, replacing contents of memory cell indicated on CRT.
	Insert	Actual settings are stored in memory; insertion is after memory cell indicated on CRT.
	Delete	Contents of memory cell indicated on CRT is deleted.
	Recall	Actual settings are replaced by contents of memory cell indicated on CRT. Actual settings are saved in "back-up" memory (= mem. cell #0).
	(Recall) Next	Actual settings are replaced by contents of memory cell indicated on CRT increased by 1. Actual settings are saved in "back-up" memory (= memory cell #0).
	(Recall) Previous	Actual settings are replaced by contents of memory cell indicated on CRT decreased by 1. Actual settings are saved in "back-up" memory (= memory cell #0).
3.9	CALCULATION FACILITIES	
3.9.1	Functions	
	RMS value	}
	Mean value	}of portion between
	Peak to peak value	}cursors, or markers if
	Rise or fall time	}LOCATE is choosen.
	Frequency (1/dt)	}
	Multiplication	Whole register.

	CHARACTERISTIC	SPECIFICATION	ADDITIONAL INFORMATION
3.10	AUTO SETTING		
3.10.1	Settling time	Typical 3 s	During plot, AUTO SET is not possible.
3.10.2	CRT functions		
	-Focus	Not influenced	
	-Trace intens	Not influenced	
	-Text intens	Not influenced	
3.10.3	Display functions		
	-Select	To register #0	
	-X-position	Zero	
	-Y-position	Zero	
	-Invert	Off	Only for register #0.
	-X-expand	*1	Vernier calibrated.
	-Y-expand	*1	
	-A versus B	Off	Only for register #0.
3.10.4	Cursors	Off	
	-Calculation	Off	
3.10.5	Text		
	-Reduced	Off	
	-Bottom text lines	Off	

CHARACTERISTIC	SPECIFICATION	ADDITIONAL INFORMATION
3.10.6 Vertical acquisition		
Y-deflection source	Every source having a triggerable signal at its input	}Channel A if no trigger }is found. }
Input impedance		
-Accessory with probe read out	According to probe read out	
-Otherwise	Not affected by AUTO SET	
Input coupling	ac	
Y-deflection		Each channel is independently set.
-10 mV <input voltage <30 V	Approx. 4 div	} }Vernier in calibrated }position. }
-Input voltage <10 mV	Channel at 200 mV/div	} }
		Due to trigger uncertainty at freq. > 60 MHz or at duty cycle <> 50% sensitivity can deviate from above, but signal will remain on the screen.
Channel inverter	Off	
-Add	Off	
-MIN / MAX	Off	
-Bandwidth limiter	Off	
-Average	Off	
-Offset	Zero	
Y base line position		
-In single channel display	Centre of screen + 0,3 div	
-In dual channel display		
Ch. A	2 + 0,3 div above centre screen	
Ch. B	2 + 0,3 div below centre screen	

CHARACTERISTIC	SPECIFICATION	ADDITIONAL INFORMATION
3.10.7	Horizontal acquisition	
Mode	Recurrent	
External clock	Off	
TB deflection coefficient		For TVF not affected.
-Signal frequency 40 Hz ... 80 MHz	Min. 2, max 6 signal periods over 10 div.	
-Signal freq. > 80 MHz	5 ns/div	
-When no trigger found	2 ms/div	
3.10.8	Triggering	
-Delay	Off	For TVF not affected.
-Events	Off	For TVF not affected.
-Source		
Triggerable signal @ ext input	Ext	
No signal @ ext input, but trigg. signal @ channel A or B	Channel A or B	Channel with lowest input frequency is selected. (Channel A when frequencies are equal).
No triggerable signal @ any input	Channel A	
-Mode	Auto	For TVF not affected
	TVF	Trigger on fieldpulse with CCIR TV system.
-Level	50 ... 70% of peak to peak value	Dc component of signal neglected.
-LF reject	Off	
-HF reject	Off	
-Slope	Positive	For TVF not affected.

	CHARACTERISTIC	SPECIFICATION	ADDITIONAL INFORMATION
3.11	CURSORS		
3.11.1	Cursor intensity control	Independent of trace intensity but combined with text intensity	
3.11.2	Horizontal resolution		
	-In single channel mode	1 : 4096	
	-In dual channel mode	1 : 2048	
3.11.3	Vertical resolution	1 : 1024	
3.11.4	Read out resolution	3 digits	
3.11.5	Voltage cursors		
	-Error limit < Ambient: 15..35°C	<u>+ 2 %</u>	Referred to input at BNC, error of probes etc. excluded. Add 3 % for ambient: 0...50°C.
	-Cursor Range	Visible part of signal	Cursors cannot pass each other, (to avoid negative readings).
3.11.6	Time cursors		
	-Error limit	<u>+ 0,2 %</u>	
3.12	CALIBRATOR		
3.12.1	Wave form		
	-Shape	Square wave	
3.12.2	Internal impedance	50 Ohm <u>+ 1 %</u>	
3.12.3	Output voltage (peak to peak)	1 V <u>+ 1 %</u>	Open voltage; (halves when terminated with 50 Ohm). Positive going with respect to ground.
3.12.4	Output current (peak to peak)	20 mA <u>+ 2 %</u>	Output short circuited; (halves when terminated with 50 Ohm).
3.12.5	Frequency	2 kHz	

	CHARACTERISTIC	SPECIFICATION	ADDITIONAL INFORMATION
3.13	POWER SUPPLY		
3.13.1	Source voltage a.c. (r.m.s)		
	-Nominal	100 V ... 240 V	
	-Limits of operation	90 V ... 264 V	
3.13.2	Source frequency		
	-Nominal	50 Hz ... 400 Hz	
	-Limits of operation	45 Hz ... 440 Hz	
3.13.3	Source waveform characteristics		@ Nominal source voltage.
	-Max. waveform deviation factor	10%	
	-Crest factor	1,27...1,56	
3.13.4	Allowable power source interrup- tion	At least 20 ms	@ Nominal source voltage. After this time oscillo- scope settings are saved before instrument goes down. Automatic power up after restoration of Power line voltage. (For setting retention: see 3.15.1).
3.13.5	Power consump- tion (a.c. source)		@ Nominal source voltage.
	-Nominal	160 W	

CHARACTERISTIC	SPECIFICATION	ADDITIONAL INFORMATION
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3.14 OPTIONS

For specification of an option refer to the separate manual of the option.

CHARACTERISTIC	SPECIFICATION	ADDITIONAL INFORMATION
3.15	SUNDRIES	
3.15.1	Data and settings retention	When instrument is switched off or during line power failure.
-Memory back up voltage	2 V ... < 3,5 V	
-Memory back up current drain	Typical 12 uA	@ 25°C.
-Recommended Batteries: type	LR 6	According to IEC 285, (= Alkaline manganese penlight battery), e.g. PHILIPS LR6 (9299 000 20734) or DURACELL MN 1500.
quantity	2 pcs	
-Temperature rise of batteries	20 K	After warming up period of instrument.
-Retention time	Typical 2 years	@ 25°C, with recommended (fresh) batteries.
-Temperature Range	0...+70°C	@ -40...0°C settings retention is uncertain. It is advised to remove batteries from instrument when it is stored during longer period (> 24 h) below -30°C or above 60°C. UNDER NO CIRCUMSTANCES BATTERIES SHOULD BE LEFT IN THE INSTRUMENT @ TEMPERATURES BEYOND THE RATED RANGE OF THE BATTERY SPECIFICATIONS!



CHARACTERISTIC	SPECIFICATION	ADDITIONAL INFORMATION
3.15.2	Probe Read Out	With Philips probe provided with indicator ring.
-Input impedance setting		
Passive high impedance probe	}Fixed @ 1 MOhm }	
Passive 50 Ohm probe	} }	
Passive 50 Ohm attenuator	} }	
Passive 75 Ohm in 50 Ohm out	}Fixed @ 50 Ohm }	
attenuator	} }	
Active current probe	} }	
Active isolation probe	} }	
-Vertical sensitivity setting		
Passive probe	Not affected	
Passive attenuator	Not affected	
Active current probe	20 mV/div	Can be manually changed.
Active isolation probe	20 mV/div	Can be manually changed.
-V/div and voltage cursor read out		
Passive 10:1 probe	10 x higher	}
Passive 10 x attenuator	10 x higher	}
Passive 100:1 probe	100 x higher	}Offset read out is }
Passive 100 x-attenuator	100 x higher	}changed accordingly. }
Active current probe	In divisions	}
Active isolation probe	In divisions	}

CHARACTERISTIC	SPECIFICATION	ADDITIONAL INFORMATION
3.15.3	Analog plot output	
-Connector	DIN 5 pole 45°	
-Functions	Screen dump Memory dump	Included channel identifier. Register selectable.
-Sensitivity	1 V/Full screen + 3 % 1 V/Full memory + 3 %	} }Horizontal and vertical. } }
-Pen lift	TTL compatible	Pen-up is selectable (0 or 1). Open collector output; max. 12 V.
-Plot time per dot	20 ms .. 2 s	Software selectable. Signal dependent.
-Plot sequence	Channel A first	In dual channel operation; with more registers starting with the lowest number.
3.16	MECHANICS	
3.16.1	Height	Fits 5E in 19 inch rack.
-Without feet and accessory pouch	176 mm (6,9 in.)	Add 15. mm (0,6 in.) for feet.
-Feet and accessory pouch included	250 mm (9,8 in.)	
3.16.2	Width	Add 46 mm (1,8 in.) for handle.
3.16.3	Depth	
-Handle excluded	570 mm (22,5 in.)	Add 35 mm (1,4 in.) for protective front cover.
-With extended handle	670 mm (26,4 in.)	
3.16.4	Mass	18 kg
3.16.5	Operating position	Horizontal Standing on feet; may be tilted by handle.
3.16.6	Finish	Epoxy powder coated
3.16.7	Printed circuit boards	Glass laminate epoxy
3.16.8	Cooling	Fan aided convection Maintenance free.

CHARACTERISTIC	SPECIFICATION	ADDITIONAL INFORMATION
3.17	ENVIRONMENTAL	
3.17.1	General	
	The characteristics are valid only if instrument is checked in accordance with the official checking procedures. Details on these procedures and failure criteria are supplied on request.	
3.17.2	Meets environmental MIL-T-28800C Type III requirements of Class 5, Style D	
3.17.3	Temperature	Memory back-up batteries removed from instrument, unless batteries meet temperature specifications (see also 3.15.1).
	-Operating	
	Min. low temperature $0^{\circ}\text{C}$	Cf. MIL-T-28800C par. 3.9.2.3 tested cf. par. 4.5.5.1.1.
	Max. high temperature $+ 50^{\circ}\text{C}$	Cf. MIL-T-28800C par. 3.9.2.4 tested cf. par. 4.5.5.1.1.
	-Non operating (Storage)	
	Min. low temperature $-40^{\circ}\text{C}$	Cf. MIL-T-28800C par. 3.9.2.3 tested cf. par. 4.5.5.1.1.
	Max. high temperature $+ 75^{\circ}\text{C}$	Cf. MIL-T-28800C par. 3.9.2.4 tested cf. par. 4.5.5.1.1.
3.17.4	Maximum humidity	Cf. MIL-T-28800C par. 3.9.2.2 tested cf. par. 4.5.5.1.1.
	-Operating and non-operating (Storage) 95% Relative humidity	

CHARACTERISTIC	SPECIFICATION	ADDITIONAL INFORMATION
3.17.5	Maximum altitude	Cf. MIL-T-28800C par. 3.9.3 tested cf. par. 4.5.5.2.
	-Operating	4,5 km (15000 feet)
	-Non-operating (storage)	12 km (40000 feet)
3.17.6	Vibration (Operating)	Cf. MIL-T-28800C par. 3.9.4.1 tested cf. par. 4.5.5.3.1.
	-Freq. 5...15 Hz	
	Sweep time	7 min
	Excursion (pk to pk)	1,5 mm
	Max acceleration	7 m/s <sup>2</sup> (0,7 x g) @ 15 Hz.
	-Freq. 5...25 Hz	
	Sweep time	3 min
	Excursion (pk to pk)	1,0 mm
	Max acceleration	13 m/s <sup>2</sup> (1,3 x g) @ 25 Hz.
	-Freq. 25...55 Hz	
	Sweep time	5 min
	Excursion (pk to pk)	0,5 mm
	Max acceleration	30 m/s <sup>2</sup> (3,0 x g) @ 55 Hz.
	-Resonance dwell	10 min @ each resonance freq. (or @ 33 Hz if no resonance was found). Excursion cf. 3.17.6.
3.17.7	Shock (Operating)	Cf. MIL-T-28800C par. 3.9.5.1 tested cf. par. 4.5.5.4.1.
	-Amount of shocks	
	total	18
	each axis	6 (3 in each direction).
	-Shock wave form	half sine wave
	-Duration	11 ms
	-Peak acceleration	300 m/s <sup>2</sup> (30 x g)

	CHARACTERISTIC	SPECIFICATION	ADDITIONAL INFORMATION
3.17.8	Bench handling		Cf. MIL-T-28800C par. 3.9.5.3 tested cf. par. 4.5.5.4.3.
	-Meets requirements of:	MIL-STD-810 methode 516, proced. V	
3.17.9	Salt atmosphere		Cf. MIL-T-28800C par. 3.9.8.1 tested cf. par. 4.5.6.2.1.
	-Structural parts meet requirements of:	MIL-STD-810 methode 509, proced. I salt solution 20%	
3.17.10	EMI (Electro magnetic interface) meets requirements of:	MIL-STD-461 Class B  VDE 0871 and VDE 0875 Grenzwertklasse B	Applicable requirements of Part 7: CE03, CE07, CS01, CS02, CS06, RE02, RS02, RS03.
3.17.11	Magnetic radiated susceptibility		Tested conforming IEC 351-1 par. 5.1.3.1.
	-Maximum deflection factor	7 mm/mT (0,7 mm/gauss)	Measured with instrument in a homogeneous magnetic field (in any direction with respect to instrument) with a flux intensity (peak to peak value) of 1,42 mT (14,2 gauss) and of symmetrical sine wave form with a frequency of 45...66 Hz.
3.17.12	Packing		
	Meets requirements of:	NLN-L88	
3.17.13	Transportation		
	Meets requirements of:	AN-D628	
	-Packaged transportation drop meets requirements of:	Mat. safe transp. ass. procedure 1A-B-2	
	-Packed transportation vibration meets requirements of:	Mat. safe transp. ass. procedure 1A-B-1	

CHARACTERISTIC	SPECIFICATION	ADDITIONAL INFORMATION
3.18	SAFETY	
3.18.1	Meets requirements of:	
	IEC 348 Class I	
	VDE 0411 Class I	
	UL 1244	
	CSA 556B	
3.18.2	Approvals	
	VDE 0411 (applied for)	
	UL 1244 (applied for)	
	CSA 556 (applied for)	
3.19	ACCESSORIES	
3.19.1	Accessories furnished with instrument	
	2 x PM8929/09	10 MOhm, 10:1 passive probe with read out (1,5 m).
	Blue contrast filter	Factory installed.
	Operating manual	
	Front cover	
3.20	OPTIONAL VERSIONS	
3.20.1	General	These options can be factory installed only.
3.20.2	Power Cord	
	Universal european	}Length 2,1m , (82,7 in.).
	North american	}VDE, KEMA listed.
	United kingdom	}CSA, UL listed.
	Swiss	}BSI listed.
	Australian	}SAV listed.
		}SAA listed.
3.20.3	Cabinet	
	Rack mount	

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ADDITIONAL INFORMATION

3.20.4 IEEE/RS-232C  
interface

PM8956

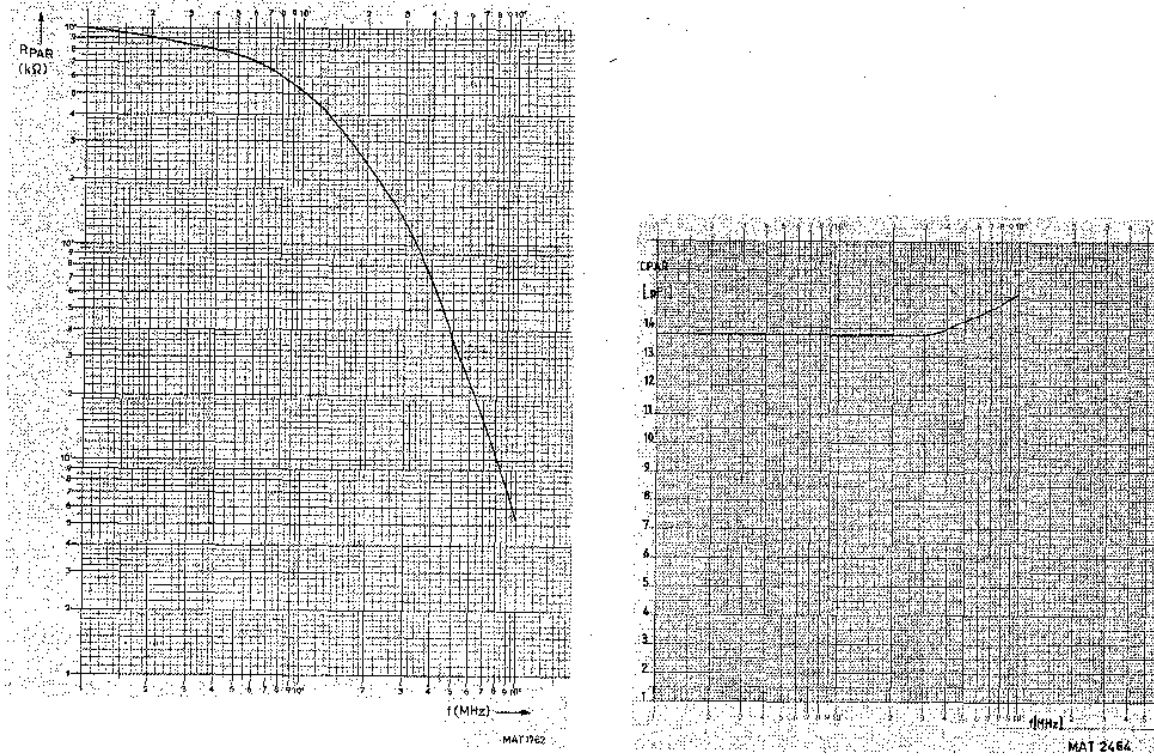


Figure 3.1. Input resistance  $R_{par}$ . and capacitance  $C_{par}$ . versus frequency.

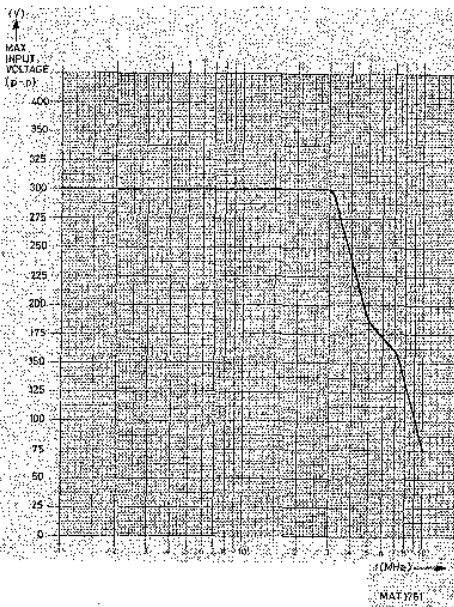


Figure 3.2. Maximum input voltage (peak to peak) derating versus frequency.