1

rejestrator x-y

R E J E S T R A T O R X ⇄ Y

1 e t a p p r o j e k t o w a n i a

Opracował inż. Tadeusz Paszenicki
maj 1975

S P I S T R E Ś C I

Z A Ł A C Z N I K I

1. Przedmiot opracowania.

Przedmiotem opracowania jest zebranie wytycznych użytkowych, ergonomicznych i plastycznych dotyczących rejestratorów x - y.

Rejestratory takie nie są dotychczas produkowane w kraju i stanowią przedmiot importu z krajów kapitalistycznych, co powoduje dotkliwy ich niedobór.

Uruchomienie produkcji rejestratora x - y według własnego opracowania konstrukcyjnego przewidziano w Ośrodku Badawczo Rozwojowym Metrologii Elektrycznej i Lubuskich Zakładach Aparatury Elektrycznej LUMEL w Zielonej Górze.

2. Obszar zastosowania wyrobu.

Rejestratory x - y oraz x - t znajdują zastosowanie m.i. jako:

a/ wyposażenie laboratoriów pomiarowych,
b/ wyposażenie przemysłowych stanowisk kontroli jakości,
c/ wyposażenie pracowni badawczych w różnych dziedzinach nauki i dydaktyki,
d/ urządzenia wyjściowe dla komputerowych systemów centralnej rejestracji,
e/ urządzenia wyjściowe dla komputerowych systemów sterowania procesami przemysłowymi,
f/ urządzenia wyjściowe dla komputerowych terminali graficznych,
g/ urządzenia wejścia/wyjścia dla komputerowych systemów inżynierskich.

3. Przegląd rejestratorów formatu A 3 produkcji zagranicznej.

3.1. Ogólne dane mechaniczne

	Firma i typ	Format zapisu mm	Szer. mm	Głęb. mm	Wys. mm	Dostępne pętwy nac.	Moc. papieru elektrost.	Moc. papieru podciśn.
1	Rhode a Schwarz ZSK 2	380x280	440	488	150	x	x	
2	Siemens Kompensograph XY	370x280	444	444	110	x	x	
3	Goerz Servogor XY RE 551	370x280	442	477	129		x	
4	Sefram Type TRP	250x250	445	355	126	x		x
5	Ifelec Type S-200	400x300	440	530	150	x		x
6	Watanabe WX 411	380x250	446	500	120	x	x	
7	Bryans 26000	380x280	480	510	140			x
8	MFE Seria 800 i 1000	380x250	483	444	125			x
9	Gould Brush 500	380x250	483	533	178		x	
10	Hewlett Packard 7040 A 7041 A OEM X-Y Recorders	380x250	483	356 400	165		x	
11	Hewlett Packard 7044 A	380x250	483	400	165		x	
12	Hewlett Packard 7047 A	380x250	483	441	173		x	
13	Houston Instruments 2000	380x250	447	400	165	x		x

3.2. Dane charakterystyczne generatorów podstawy czasu.

		Podstawa czasu				Ilość podzakresów	Prędkości			Czas zapisu	
		Standard	Opcja	Wbudowane	Nakładane		min.	maks.	jedn.	min.	maks
										s	min
1	Rhode a Schwarz ZSK 2	x[1]		x[2]		9	0,2	120	s/cm	7,6	76
2	Siemens Kompensograph XY		x	x		11	0,05	100	mm/s	3,7	123
3	Goerz Servogor XY RE 551	x		x		8	0,1	20	s/cm	3,7	12
4	SSefram Type TRP 1-100					9	0,25	100	s/cm	6,2	41
5	Ifelec Type S-200		x	x		7	0,2	20	s/cm	8	13
6	Watanabe WX 411	x		x[2]		7	0,2	20	s/cm	7,6	12
7	Bryans 26000 [3]		x	x		9	0,05	20	s/cm	1,4	12
8	MFE seria 800 i 1000 [3]		x		x	7	0,25	25	s/cm	6,2	15
9	Gould Brush 500 [3]		x		x	9	0,1	50	s/cm	1	12
10	Hewlett Packard 7040 A 7041 A OEM X-Y Recorders		x[4]			5	0,5	50	s/cm	19	30
11	Hewlett Packard 7044 A [3]		x	x		6	0,25	50	s/cm	6,2	30
12	Hewlett Packard 7047 A [3]	x		x		6	0,1	50	s/cm	1	30
13	Houston Instruments 2000 [3]		x[5]	x		11	0,05	100	s/cm	1,2	63

1) w wersji laboratoryjnej
2) wspólnie z podzakresami wzm osi x
3) podstawa czasu dla obu osi: x-t oraz y-t
4) dostępne opcje na poszczególne prędkości
5) do dyspozycji trzy moduły z podstawą czasu dla obu osi, dane w tabeli dla moduku Type 6 o największej rozpiętości.

4. Proponowana koncepcja układu projektowanie-produkcja-sprzedaż dla rodziny rejestratorów/plotterów LUMEL

Rozeznanie dokonane przez OBR ME wskazuje na duże zainteresowanie odbiorców krajowych zarówno klasycznym rejestratorem x-y, jak i rejestratorem typu plotter. Obserwowany szybki rozwój systemów pomiaru iautomatyki /ostatnio z wykorzystaniem minikomputerów/ zapewnia duży rynek zbytu dla rejestratorów i plotterów.

Możnaprzewidywać także zainteresowanie konstrukcją odbiorców zagranicznych, w tym przypadku jednak ekspansja eksportowa stawia ograniczenia i wymagania znacznie poważniejsze, niż produkcja na rynek krajowy. Można liczyć na poważniejszy eksport na rynki KK, jeżeli:

1. wyrób będzie zachowywał parametry techniczne przyjęte aktualnie na świecie za niezbędne dla danej klasy i zastosowania sprzętu,
2. wyrób będzie konkurencyjny cenowo i dostarczany w krótkich terminach.

Możnaprzewidywać, że realizacja warunku 1. nie sprawi większego kłopotu kadrze technicznej OBR ME i przedsiębiorstwa. Spełnienie warunku 2. jest jednak znacznie trudniejsze z uwagi na naturalną sprzeczność między koniecznością oferowania niewielkich często serii rejestratora o żądanych parametrach - a oczywistą zasadą osiągania niskich kosztów produkcyjnych przy dużej produkcji i bogatym oprzyrządowaniu.

Ten trudny problem wydaje się możliwy do przezwyciężenia dzięki temu, że OBR ME oraz ZZAE LUMEL nie posiadają praktycznie dorobku w temacie rejestrator x-y/plotter i nie są skrępowane koniecznością rozwijania lub adaptacji starych rozwiązań.

Wydaje się oczywiste, że zapewnienie w tych warunkach konkurencyjności cenowej i przyszłej ekspansji eksportowej jest możliwe tylko przy nadzwyczaj starannym opracowaniu konstrukcyjnym wyrobu i bardzo szczegółowym ustaleniu wielu ograniczeń konstrukcyjnych i unifikacyjnych już w fazie konstrukcji modelu.

Wynika z tego niewygodna i trudna do spełnienia konieczność prowadzenia bardzo szerokiego frontu prac konstrukcyjnych, zarówno elektrycznych jak i mechanicznych, już na samym początku opracowania / z tendencją do zmniejszania ilości zatrudnionych przy konstrukcji w dalszych etapach pracy/.

Spodziewanym efektem takiego ustawienia prac będzie przyspieszenie i zmniejszenie zakresu prac nad technologią i oprzyrządowaniem /przez szeroką unifikację/. Efektem będzie też jednoczesne wyprodukowanie, wypróbowanie i ewent. skierowanie na wybrany rynek kilku wersji rejestratora/plottera przeznaczonych na różne obszary zastosowań.

Jednocześnie z produkcją serii próbnej wyrobu należy przewidywać utworzenie wyspecjalizowanej służby serwisowej, która wstępną praktykę przejdzie przy montażu i strojeniu egzemplarzy serii próbnej.

Problem ustalenia harmonogramu prac konstrukcyjnych rejestratora/plottera i terminów uruchamiania produkcji jest bardzo istotny i wymaga dogłębnego rozważenia. Wiąże się to z zagadnieniem odpowiedniego przedstawienia konstrukcji /zwłaszcza wobec importerów zagranicznych/ i przekonania użytkowników już na etapie serii próbnej, że oferowana konstrukcja została opracowana z pełną znajomością potrzeb użytkowników.

Oddzielnego ustalenia wymaga sporządzenie pełnej listy wymagań i ograniczeń, wynikających z istnienia norm i zaleceń organizacji międzynarodowych, ustaleń wyspecjalizowanych komisji RWPG /np Jednolity System Minikomputerów oraz ASU/. Wyniknie prawdopodobnie konieczność dostosowania konstrukcji do zaleceń standardowego interface, określonego wstępnie dokumentem IEC 66/Secretariat/28 - July 1974.
Odbitki części tego dokumentu załączono na następnych stronach.

5. Proponowana zasada konstrukcji modułowej.

W przypadku uznania za uzasadnione założeń podanych w punkcie 4 niniejszego opracowania logiczną konsekwencją powinno być przyjęcie następujących zasad projektowania konstrukcji od strony mechanicznej i elektrycznej.

Rejestrator x-y LUMEL oraz plotter graficzny LUMEL są konstrukcjami sfunkcjonalizowanymi, maksymalnie ze sobą zunifikowanymi.

Rejestrator x-y LUMEL jest konstrukcją modułową i składa się z następujących bloków funkcjonalnych /rys. 1/:

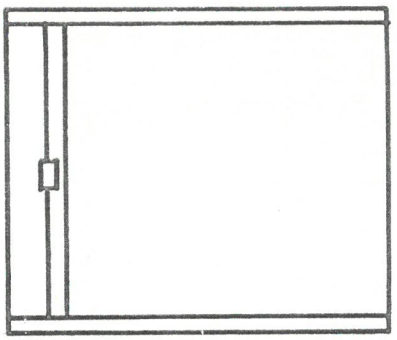
a/ blok rejestrujący
b/ moduł wejściowy osi x
c/ moduł wejściowy osi y
d/ moduł sterowania zapisem

Poszczególne moduły łączą się elektrycznie z blokiem rejestrującym przy pomocy łączówek o znormalizowanym układzie adresów. Ma to pozwolić na wykorzystywanie tego samego typu /a nawet tego samego egzemplarza/ modułu wejściowego zarówno w osi x jak w osi y.
Konieczność dostosowania produktu do wymagań różnych kategorii użytkowników zakłada opracowanie kilku typów modułów wejściowych o różnej czułości, jak również modułów z generatorem podstawy czasu, co przy założonej wymienności wzmacniaczy osi x i osi y pozwoli na uzyskanie zapisów x=f/t/ oraz y=f/t/.

Przewidywane zastosowanie w układach automatyki oraz systemach komputerowych narzuca także opracowanie modułu sterowania pozwalającego na zdalne uruchamianie rejestratora.
Proponuje się szczegółowe rozważenie celowości opracowania niektórych modułów wejściowych w wersji specjalnie dostosowanej do pracy w systemach przemysłowych. Warunki użytkowania narzucają tam celowość stosowania elementów regulacyjnych blokowanych lub trudno dostępnych. Moduły takie mogą być ponadto ukierunkowane na wąskie parametry pracy, co wpływa na ich potanienie.
Próbą takiego rozwiązania jest rejestrator Rhode i Schwarz ZSK 2 oferowany w wersji laboratoryjnej oraz systemowej. Znacznie poważniejsze efekty ekonomiczne można oczywiście osiągnąć przy proponowanej konstrukcji modułowej.

BLOK REJESTRUJĄCY

+ znacznik zdarzeń /opcja/
+ czujnik fotoel. /opcja/
+ płetwy mocujące /opcja/



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MODUŁY WEJŚCIOWE	LABORATORYJNE	SYSTEMOWE
Moduł bez wyposażenia	10	
Wzm. średniej czułości	11	21
Wzm. średniej czułości + podstawa czasu	12	
Wzm. wysokiej czułości	13	23
Wzm. wysokiej czułości + podstawa czasu	14	
2 kan. wzm. średniej czuł.	15	25
Wzm. logarytmiczny	16	
Point plotter	17	27
Generator krzywych /wsp. z czujnikiem fotoelektr./	18	

+

MODUŁY STEROWANIA		
Wył. sieci, wył. pisaka	31	[31]
Wył. sieci, wył. pisaka, przycisk znacznika	32	
Wył. sieci, autom. sterow. pisakiem i znacznikiem na poziomie TTL		33

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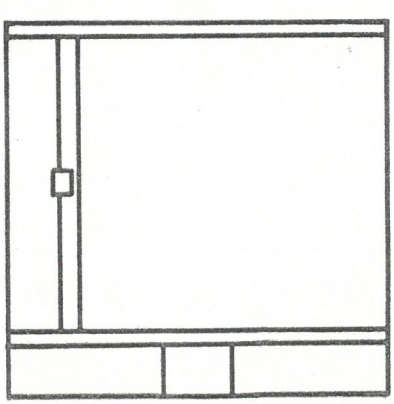
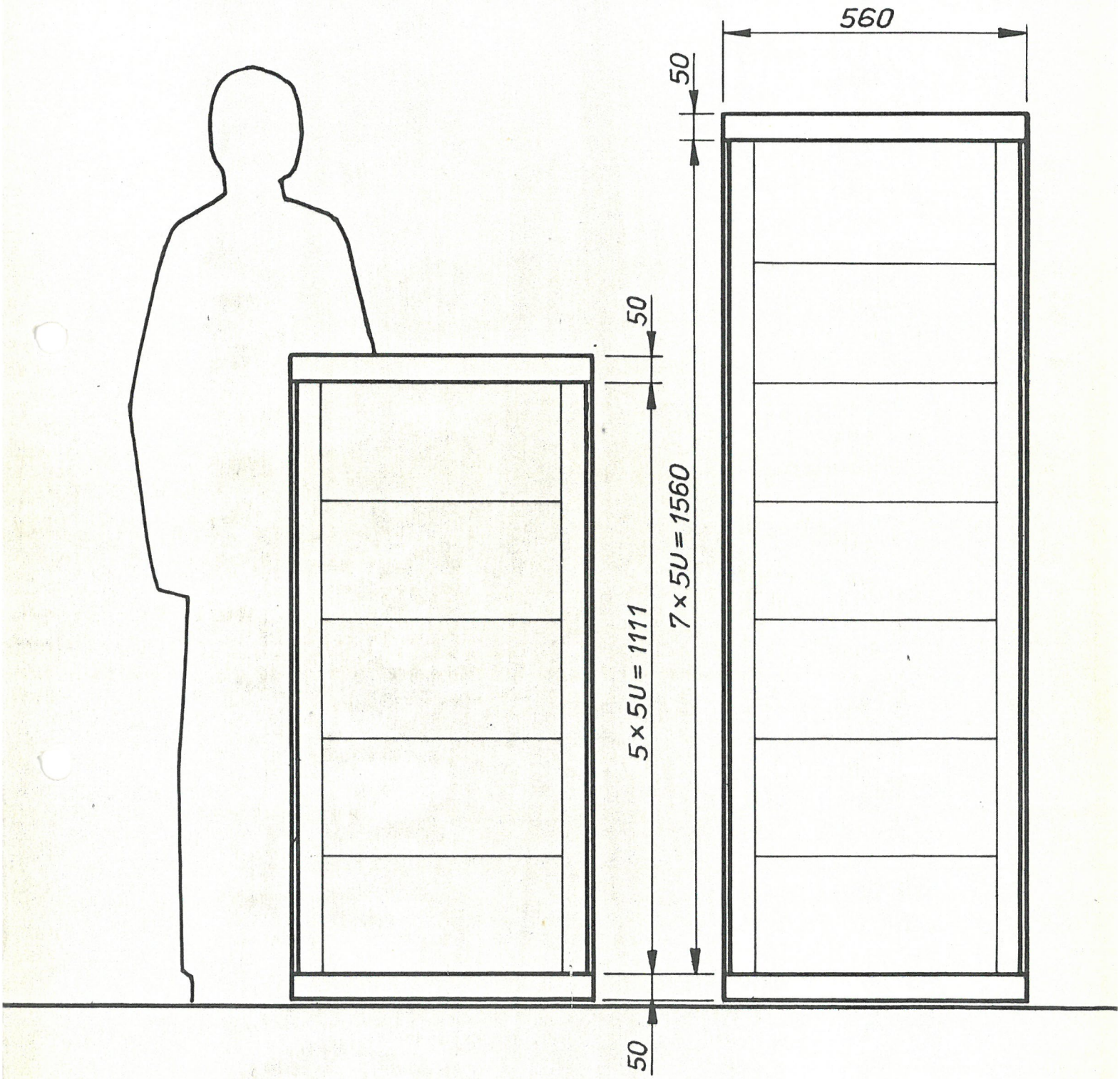
REJESTRATOR X-Y



Rys. 1. Zasada proponowanej konstrukcji modułowej rodziny rejestratorów LUMEL



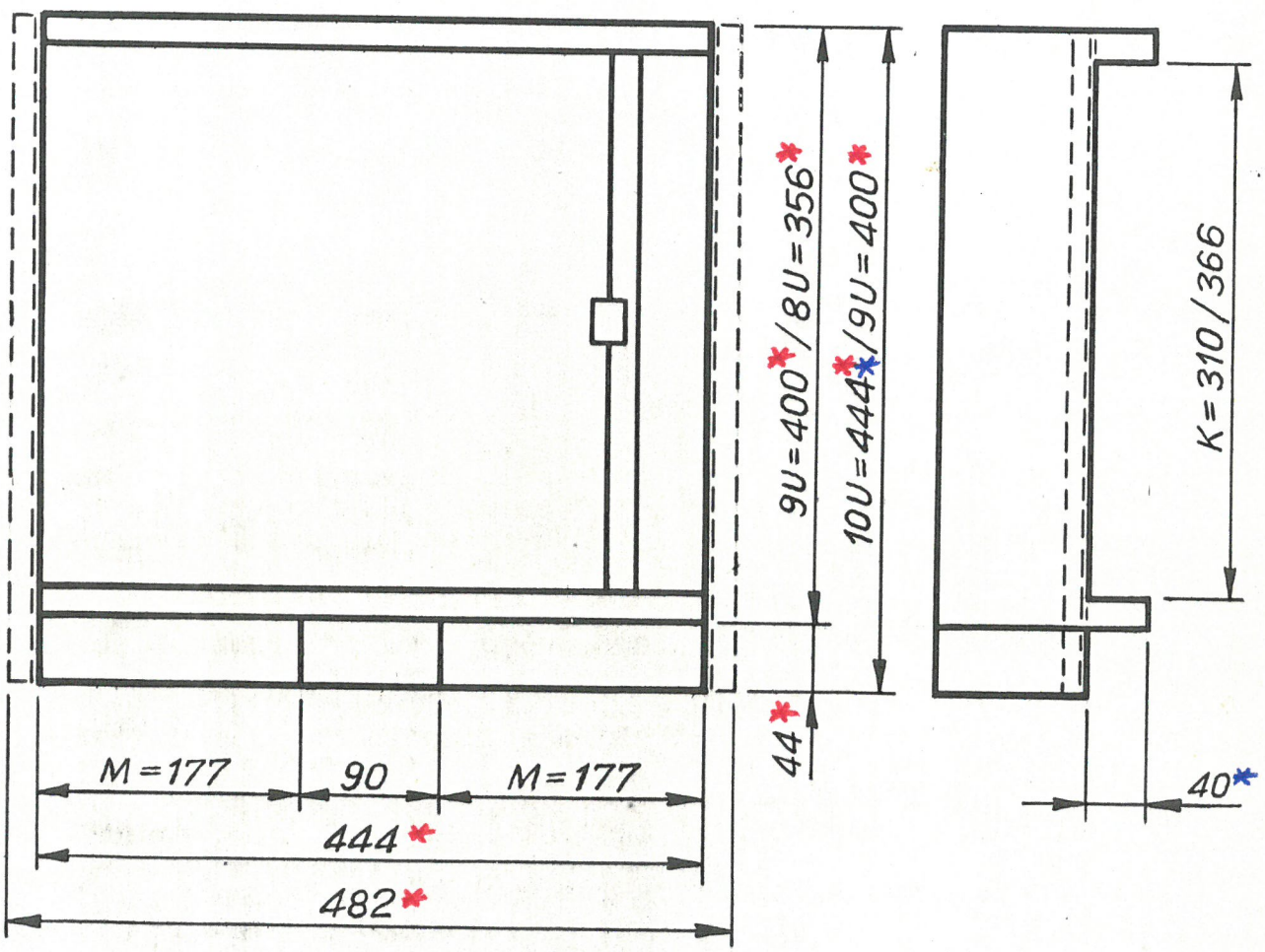
Rys. 2. Wymiary szafek 19 calowych opracowanych w OBRUI Era dla bloków Systemu MERA 300

6. Przewidywane kierunki rozwoju konstrukcji.

Proponowana zasada modułowości zakłada także oferowanie użytkownikom samego bloku rejestrującego do kompletacji na zasadach OEM, co jest stosowane przez firmę Hewlett-Packard /specjalne wersje 7040 A, 7041 A - zał. 3/ oraz przez firmę Houston Instrument w nowych konstrukcjach Omnigraphic 2000 i 3000 /zał. 6/.
Szczegółowa analiza podanych wyżej konstrukcji wydaje się uzasadniona przed akceptacją założeń na rejestrator LUMEL.
Zwłaszcza rejestrator Houston Instr. 2000 wydaje się zrealizowany dla spełnienia wymagań bardzo zbliżonych do formułowanych w niniejszym opracowaniu.
Specjalizowane moduły wejściowe do kompletacji na zasadach OEM mogą być łatwo w późniejszym okresie opracowywane i produkowane przez OBR ME.

Kierunkiem rozwoju, wymagającym istotniejszego nakładu prac jest opracowanie w przyszłości rejestratora dwupisakowego /rys. 4 i 6/ oraz rejestratora jedno- i dwupisakowego z zapisem na papierze składanym /Z-fold chart type/.

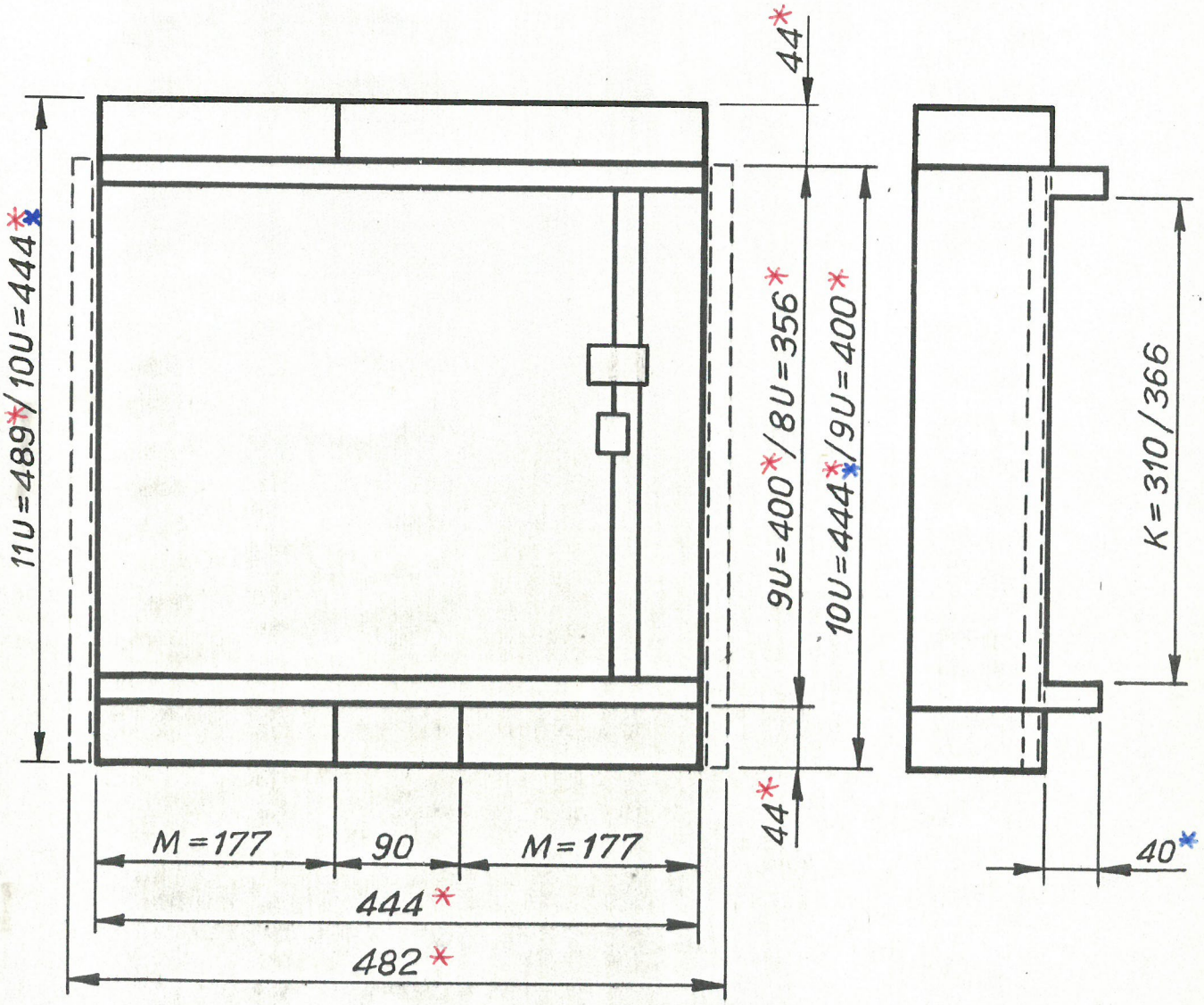
Opracowanie wersji rejestratora do zapisu ciągłego na papierze z roli, aczkolwiek konstrukcyjnie łatwiejsze, nie wydaje się przyszłościowe z uwagi na mniejsze walory użytkowe.



* wymiary wynikające z zaleceń IEC 48/CO/103 oraz IEC 48/Secr/136, BN-72/5570-04, DIN 41 494

* wymiary wynikające z konstrukcji minikomputerów System MERA 300

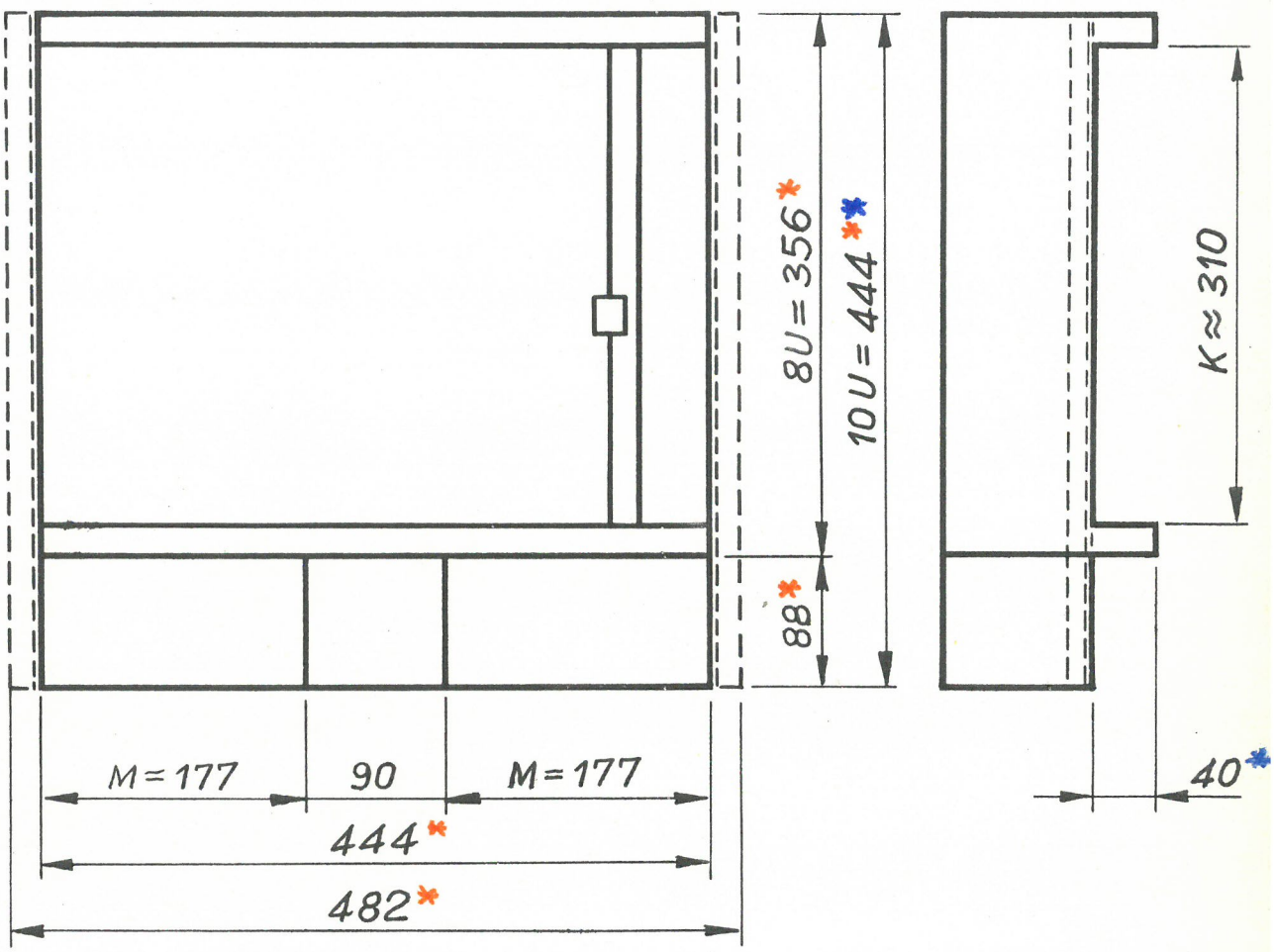
Rys. 3. Proponowane główne wymiary rejestratora LUMEL /podz. 1:5/



*wymiary wynikające z zaleceń IEC 48/CO/103 oraz IEC 48/Secr/136, BN-72/5570-04, DIN 41 494

*wymiary wynikające z konstrukcji minikomputerów System MERA 300

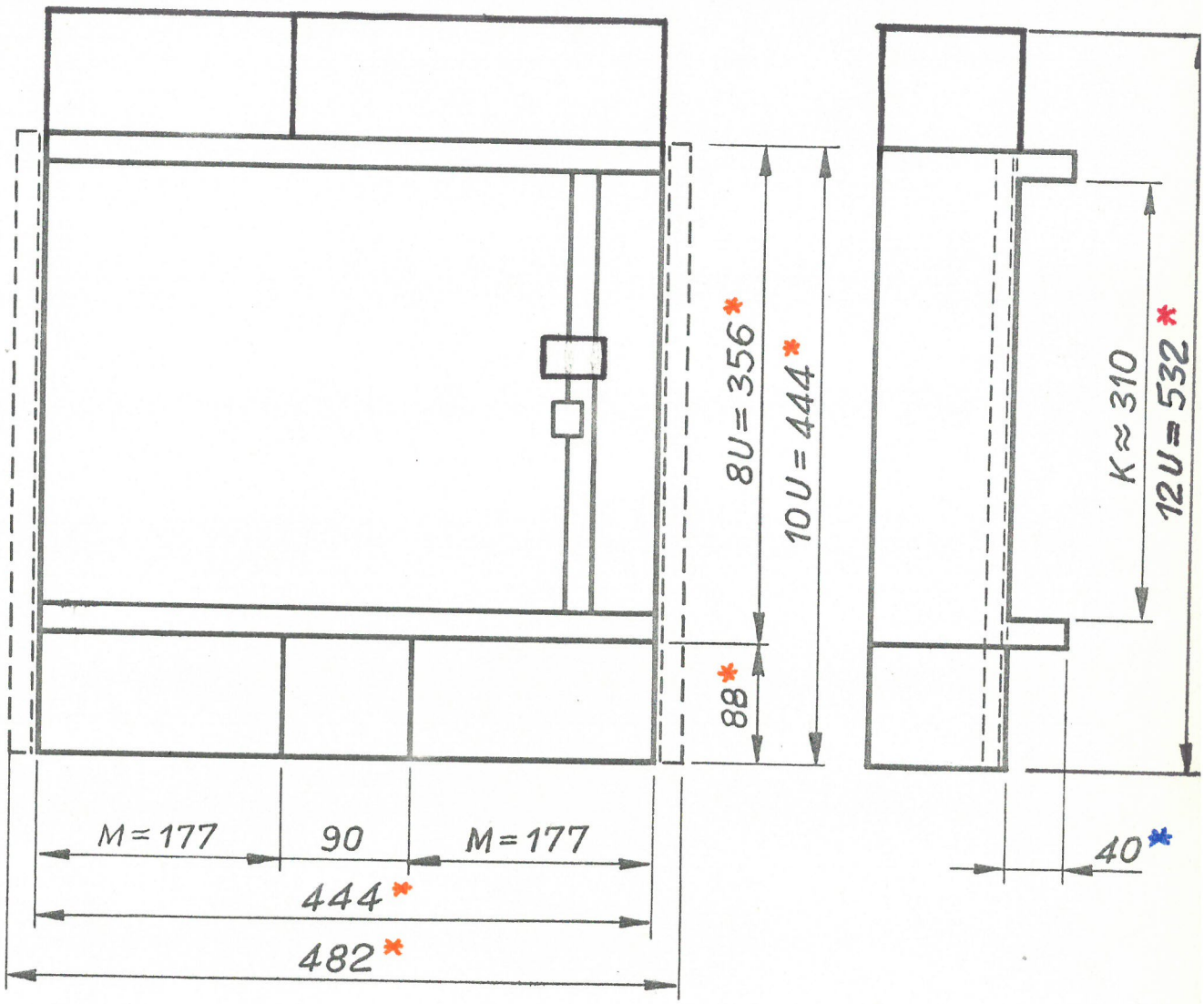
Rys. 4. Główne wymiary rejestratora LUMEL w rozwojowej wersji dwupisakowej



* wymiary wynikające z zaleceń IEC 48/CO/103, IEC 48/Secr/136, BN-72/5570-04, DIN 41494

* wymiary wynikające z konstrukcji minikomputerów System MERA 300

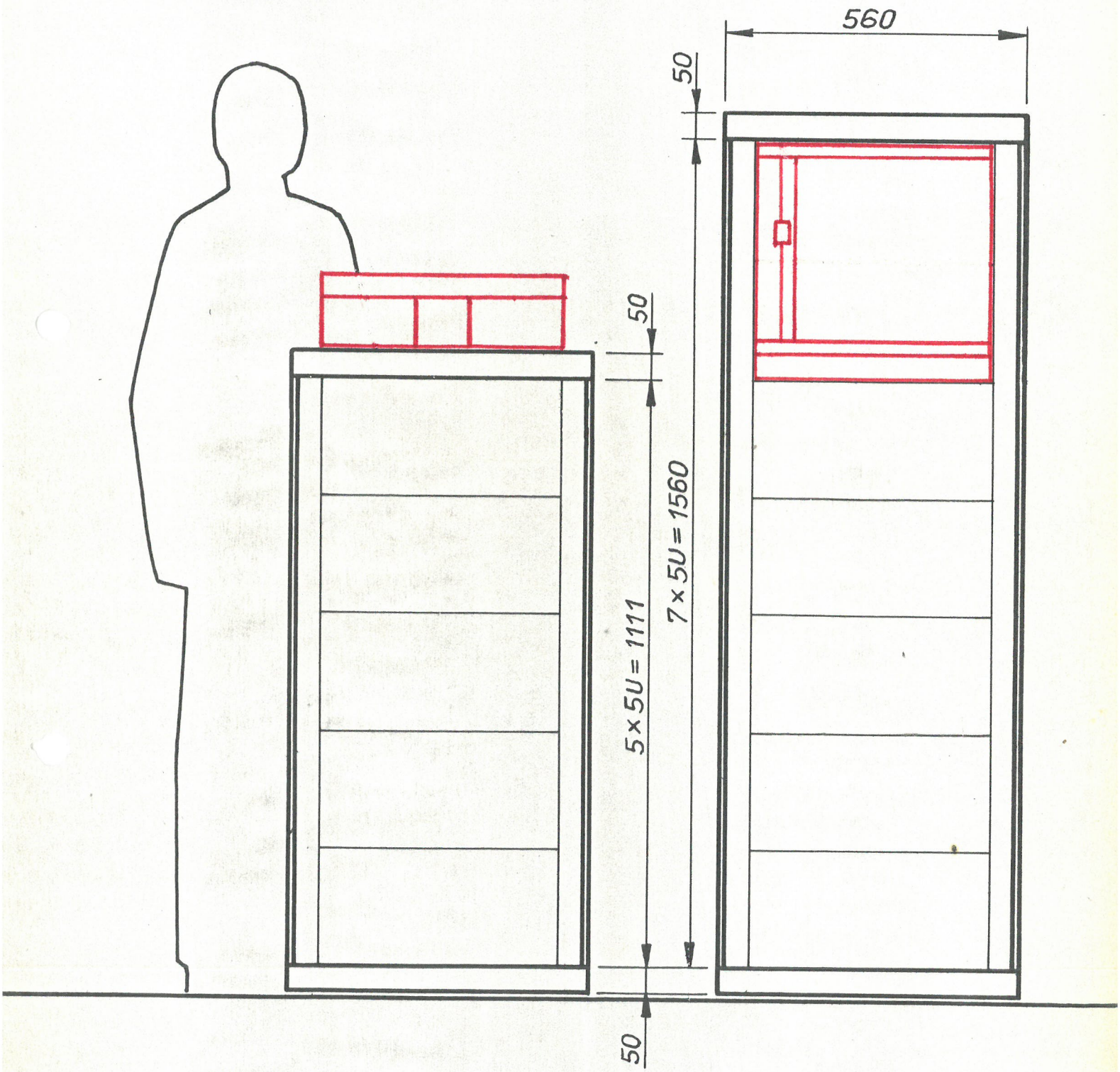
Rys. 5. Główne wymiary rejestratora LUMEL - alternatywa /wieksza powierzchnia płyt modułów wejściowych/ podz. 1:5



* wymiary wynikające z zaleceń IEC 48/CO/103, IEC 48/Secr/136, BN-72/5570-04, DIN 41494

* wymiary wynikające z konstrukcji minikomputerów System MERA 300

Rys. 6. Główne wymiary rejestratora LUMEL w wersji dwupisakowej - alternatywa /wieksza powierzchnia płyt modułów wejściowych/ podz. 1:5



Rys. 7. Możliwości umieszczenia rejestratora LUMEL w szafkach 19 calowych Systemu MERA 300

4. Proponowane główne wymiary konstrukcji.

Z uwagi naprzyjęty warunek umieszczania rejestratora w pozycji pionowej w typowych szafach i stojakach 19 calowych wymiary gabarytowe konstrukcji muszą spełniać wymagania norm BN-72/5570-04 oraz DIN 41 494, wynikające z zaleceń IEC 48/CO/103 i IEC 48/Secr/136.

Wynikające z podanych wyżej norm oraz z innych uwarunkowań proponowane wymiary konstrukcji podano na rys. 3 i 5.

Wymiar wysokości wewnętrznej łoża rejestratora /oznaczony K na rys. 3 / wynika z wymiarów papieru użytego do zapisu. Dla papieru arkuszowego formatu A 3 wymiar ten powinien wynosić ok. 310 mm.
Proponuje się jednak rozważenie przyjęcia do założeń konstrukcyjnych wymiaru K = 366 mm.
Pozwoliłoby to w przyszłości na łatwiejsze opracowanie wersji rejestratora na papier składany z perforacją brzegową / Z-fold chart pack /. Papier tego rodzaju o szerokości całkowitej 360 mm jest stosowany w drukarkach znakowo - mozaikowych DZM 180 /licencja Logabax/ produkowanych przez ZMP MERA-Błonie.
Zastosowanie wersji tego papieru z nadrukiem siatki milimetrowej oraz wykorzystanie elementów mechanizmu przesuwu papieru z DZM 180 może ułatwić prace konstrukcyjne przy nowym modelu rejestratora.
Zrezygnowanie z podanego wyżej /dyskusyjnego zresztą/ postulatu ścisłej unifikacji wymiarowej łoża rejestratora dla obu wersji pozwoli na zmniejszenie wysokości rejestratora arkuszowego o 1 U = 44 mm do wymiaru 9 U = 400 mm.
Przyjęcie w założeniach tego postulatu wymaga utrzymania wysokości całkowitej wszystkich wersji rejestratora 10 U = 444 mm, a więc wielkości stosowanej w blokach minikomputerów MOMIK 8b/100 oraz MOMIK 8b/1000.

Wymiar długości modułu wejściowego /oznaczony M na rys. 3/ jest typowym wymiarem z szeregu wysokości płyt czołowych 19 calowych / 4 U /.

Moduły wejściowe rejestratora / a tym bardziej krótsze od nich moduły sterowania/ wykonane w wymiarach podanych na rys. pozwalają w razie późniejszej potrzeby na łatwe ich przetransponowanie na:

a/ płyty czołowe międzynarodowego systemum modułowego CAMAC o wysokości 221 mm /wysokość czynna ok. 180 mm/ i szerokości 51,4 mm
lub 68,6 mm.
Obudowy systemu CAMAC produkowane są w kraju.

b/ obudowy modułowe produkcji MERA-ZAP-MONT Ostrów Wlkp. o płytach wysokości 178 mm /wysokość czynn ok. 140 mm/ i szerokości 44 mm, 66 mm, 88 mm.

c/ płyty czołowe międzynarodowego systemu modułowego AEC-NIM o wysokości 221 mm /wysokość czynna ok. 185 mm/ i szerokości 68,6 mm /szerokość czynna ok. 61 mm/ lub 103,1 mm /szerokość czynna ok. 96 mm/.

d/ płyty czołowe międzynarodowego systemu modułowego IMS o wysokości 177 mm /wysokość czynna ok. 140 mm/ lub 221 mm /wysokość czynna ok. 185 mm/ i szerokości 68,6 mm /szerokość czynna ok. 61 mm/ lub 103,1 mm /szerokość czynna ok. 96 mm/.

Podane wyżej wartości wysokości"czynnych" płyt /przestrzeń do wypełnienia elementami/ należy uwzględniać przy projektowaniu poszczególnych modułów wejściowych rejestratora.

8. Proponowane elementy typowe.

8.1. Pokrętła.

Proponuje się użycie w konstrukcji pokręteł typ E 100, produkowanych przez ZZEAP "Meratronik" /d. Elpo/ w Warszawie. Pokrętła można stosować z kilkoma typami wskaźników oraz zestawiać jako pokrętła zdwojone współosiowe. Karty informacyjne pokręteł E 100 przekazano uprzednio do ORR ME.

W konstrukcji przewiduje się zastosowanie pokręteł E 100 ϕ 15 mm oraz ϕ 23 mm w kolorze szarym w następującym asortymencie:

a/ Pokrętło ϕ 23 mm ze wsk. symbol E100-4X2-1200-30
b/ Pokrętło ϕ 15 mm ze wsk. symbol E100-3X2-1200-30
Pokrętła te po odjęciu wskaźnika /co zmienia symbol pokrętła/ mogą być używane np jako elementy zerowania.
Zestaw pokręteł współosiowych:
c/ Pokrętło ze wsk ϕ 23 mm symbol E100-4X2-1200-00
d/ Pokrętło ϕ 15 mm /korek z kropką/ symbol E100-3X2-0000-40

Uwaga: Asortyment podany tylko dla zaopatrzenia modeli i prototypów. Przed dokonaniem zamówienia należy uzgodnić średnice wałków wyjściowych i w każdej pozycji w miejsce X wpisać odpowiednio:

3	dla wałka	d = 4 mm
5		d = 6 mm
6		d = 6,35 mm
7		d = 8 mm
8		d = 9 mm
9		d = 10 mm

8.2. Zaciski wejściowe.

Proponuje się stosowanie zacisków produkcji MERA-ZSM w Warszawie, używanych już w bocznikach do mierników uniwersalnych LUMEL. Zaciski w kolorze popielatym/szarym, kolor wkładek do ustalenia na etapie modelu.

8.3. Wyłączniki i przełączniki przerzutowe.

Proponuje się użycie łączników miniaturowych produkowanych przez PAEL, jak np. łącznik miniaturowy z napędem ręcznym typ 83 - 546 - 03 /użyty w nowej konstrukcji minikomputera MERA-ZSM Warszawa/.

8.4. Wyłączniki i przełączniki przyciskowe.

Proponuje się stosowanie przełączników typu Isostat produkcji Unitra-Eltra.
Zakłady Unitra-Eltra przewidują rozpoczęcie produkcji nowego typu miniaturowego przełącznika klawiszowego segmentowego przeznaczonego do wlutowywania w płytkę drukowaną o rastrze 2,5 mm. Przełączniki 2 - 4 - 6 - 8 biegunowe. Podziałka klawiszy 10 mm 15 mm 17,5 mm i 20 mm, klawisze typowe produkowane dotychczas.
Uwaga: W przypadku stosowania przełączników Isostat podziałka klawiszy oraz kształt i barwa klawiszy do szczegółowego ustalenia w projekcie ergonomiczno-plastycznym na etapie modelu.

8.5. Elementy sygnalizacyjne.

Proponuje się stosowanie diod elektroluminescencyjnych do bezpośredniego wlutowania w płytkę drukowaną, produkowanych już przez Ośrodek Badawczo-Rozwojowy Techniki Świetlnej "Polam" w Warszawie.

Oznaczenia:		
	zielona	CQ XP 61
	żółta	CQ XP 41
	czerwona	CQ XP 01

W przypadku potrzeby stosowania typowych żarówek sygnalizacyjnych telefonicznych proponuje się stosowanie przykrywek kwadratowych 14 x 14 mm nr rys 01-0942901-0 produkcji MERA-ELWRO Wrocław współpracujących z oprawką nr rys 03-0942101-6 /załącznik nr 3/.

8.6. Łączówki

Proponuje się stosowanie złączy bezpośrednich, pośrednich oraz szufladowych prod. Unitra-Eltra /licencja ITT Cannon/.

5. Proponowane wykończenie wyrobu.

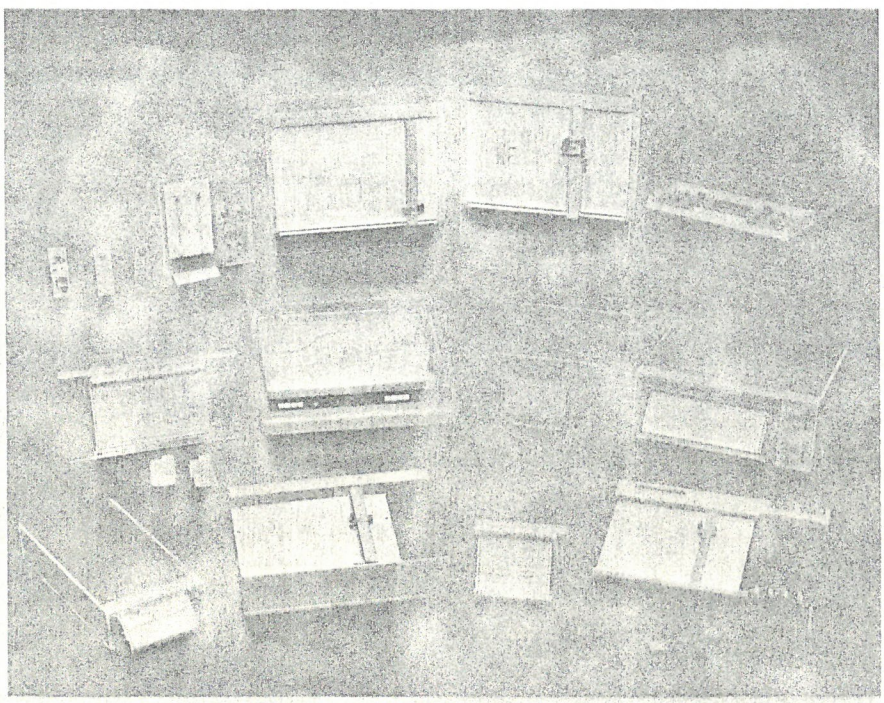
Szczegółowy układ kolorystyczny wyrobu może być ustalony w projekcie plastycznym na etapie konstrukcji modelu. Proponuje się przyjęcie kolorystyki rejestratora LUMEL identycznej jak dla wdrażanych obecnie konstrukcji mini-komputerów w MERA-ZSM Warszawa. Proponuje się używanie tych samych rodzajów pokryć lakierniczych i stosowanie identycznej technologii, wypróbowanej już w MERA-ZSM.

Przewiduje się stosowanie zestawu dwu zasadniczych barw.
Dla obudowy zewnętrznej i szkieletów:
emalia ftalowa karbamidowa specjalna schnąca w piecu w temp. 110 - 130°C S1 wg BN-73/6115-24 kolor popielaty jasny symbol 3463-317-810.
Dla płyt czołowych oraz niektórych elementów obudowy:
emalia ftalowa karbamidowa ogólnego stosowania schnąca w piecu w temp. 110 - 130°C wg BN-73/6115-24 kolor czarny półmatowy symbol 3461-364-992
lub jako zastępcza:
emalia ftalowa karbamidowa specjalna schnąca w piecu w temp. 110 - 130°C S1 wg BN-73/6115-24 kolor czarny półmatowy symbol 3463-316-992.

Proponuje się rozważenie możliwości stosowania dla strony zewnętrznej płyt czołowych importowanej powłoki matowej typu NEXTEL kolor symbol 3101-B 21 produkcji firmy 3M /East/ AG, 6301 Zug, Bearerstrasse 8, Szwajcaria /import przez centralę CIECH Warszawa/.
Szczegółowe informacje o właściwościach powłoki oraz o technologii nanoszenia podane w załączniku 4.

Przewiduje się wykonywanie napisów i informacji na płytach czołowych metodą sitodruku. Szczegóły możliwe do ustalenia w projekcie ergonomiczno-plastycznym na etapie konstrukcji modelu.

Zeta 1



Introduction

Hewlett-Packard offers a wide selection of recorders that record and display data accurately, quickly, and reliably. Some areas of application include manufacturing, education, laboratories, and hospitals. The recorders can also be utilized by the original equipment manufacturer (OEM) to fulfill the need for recording and displaying data from the OEM's equipment. The wide selection includes X-Y, strip chart, oscillographic, and instrumentation tape recorders, along with graphic plotters for computer, timeshare, and calculator users. For more detail, refer to the specific type of recorder or graphic plotter which fits your application.

X-Y recorders

The Hewlett-Packard X-Y Recorders are designed for the laboratory or the industrial user to plot Cartesian Coordinate graphs from dc electrical information. This results in providing the most effective methods for presenting related data clearly.

A self-balancing potentiometer circuit compares an unknown external voltage with a stable internal reference voltage. The difference between these voltages is amplified and applied to a servo motor to drive a potentiometer in a direction that will null any difference or error voltage.

A stepped attenuator or range selector is included for each axis, so voltages as high as 500 volts may be handled directly. Input resistance is typically 1 megohm. Sensitivity may be as high as 20 μV/cm for dc.

Zeroing potentiometers permit the user to locate the plotting origin as desired.

To fit the range of the recorder's response exactly to the coordinates of the paper in use, or to the units of measurement desired, a continuously adjustable vernier control may be switched in as a substitute for the calibrated control. Thus, the response range of the recorder can be adjusted smoothly to match, for example, some calibrated maximum from a transducer, so the paper's coordinates directly correspond to the desired units of measurement (psi, °C, etc.).

Applications

The X-Y Recorders may be selected among models in the two basic chart sizes and from three basic levels of performance depending upon measurement needs. Certain models have high sensitivity and high common mode rejection. Models are available with and without time sweep capability. Metric and English models are available. Additionally, two pen models may also be selected which are capable of simultaneously plotting two curves. Whether the application be in the Bio-Medical, Chemical, Material Testing, etc., a wide variety of X-Y Recorders is available to fit the requirement.

Plug-in modules

To expand the versatility and application of one group of X-Y recorders, plug-in modules are provided. If the application changes, the needed measurement capability is available by simply adding an inexpensive plug-in. In addition to these advantages, their high dynamic performance allows the recorders to be used in practically any application.

Recorders that utilize plug-ins include the 7004B and 7034A. The modules available include Amplifiers, Time Bases, DC offset, Filters and Null Detector. The flexibility inherent in the plug-ins will meet the constantly changing requirements of laboratory measurements.

Hewlett-Packard X-Y recorders

Description	Model	Chart Size	Maximum Sensitivity (mV/cm)	Other
General Performance	7035B	8½ × 11	0.4	External Time Base Available
	136A	8½ × 11	0.2	Two Pen, Time Base Standard
	7015A	8½ × 11, A4	1.0	Time Base Optional
	7044A	11 × 17 and A3	0.25	Time Base Optional
High Performance	7004B	11 × 17	0.25	Uses Plug-ins
	7034A	8½ × 11	0.25	Uses Plug-ins
	7045A	11 × 17 and A3	0.25	High Speed
	7046A	11 × 17 and A3	0.25	Two Pen
	7047A	11 × 17 and A3	0.02	High Perf. Input, DC Offset
OEM	7040A	11 × 17 and A3	0.2	Single Sensitivity
	7041A	11 × 17 and A3	0.2	High Speed
	7010A	8½ × 11 and A4	1.0	Single Range

Digital graphic plotters

The Hewlett-Packard Graphic Plotters offer the user an opportunity to produce graphs of computer-generated data. They operate with terminals which communicate with a computer directly or in a time-sharing environment. Simple mnemonic commands, which can be generated by any computer in any language, are used to feed data and control the plotter.

Data is supplied in pairs of four-digit X and Y coordinates so each new data point is totally defined and not dependent upon the accuracy of previous points. As true vector plotters, the 7200 series interpolate straight lines between data points, eliminating the need for the computer to generate immediate points.

Applications

Graphic plotters are particularly useful for the graphing of functions, curve fitting, regression analysis, transfer functions, probability distribution, shear and moment diagrams, checking of numerical control machine programs, or anything else that can be graphed. BASIC routines for curve and alphanumerical generation are available to be used on major time-sharing systems.

Strip chart recorders

Hewlett-Packard Strip Chart Recorders are servo driven devices designed to provide permanent records of slowly varying analog signals versus time. Pen movement on these instruments is accomplished by comparing the input signal with the voltage present along the internal linear feedback element (slidewire), amplifying this error signal and applying it to a servo motor. The motor then repositions the slidewire contact until electrical balance is achieved. Systems using this technique can be expected to have accuracies around 0.2 percent of full scale and have full scale response times of from ⅛ to ½ second.

Movement of the time axis in most strip charts is accomplished by a synchronous motor. The accuracy is, therefore, dependent on the frequency stability of the power input. It is necessary to specify either 50 or 60 Hz operation when the instrument is ordered. One recorder, the 7155A Portable, uses a stepper motor drive in conjunction with an internal oscillator and, therefore, operates independently of line frequency.

Writing systems

Hewlett-Packard Strip Chart Recorders provide two types of writing systems; capillary ink and disposable pens (ink).

Capillary ink systems use replaceable ink cartridges and have been traditional on SCR's for many years. More recently, disposable pens have been introduced which permit the user to rapidly change ink colors and perform less ink system maintenance.

Oscillographic recorders

The advantages of using direct writing recorders are highlighted by the Hewlett-Packard Oscillographic Recorder family.

Time correlation of multiple channels of data, instantaneous read out, and the capability to use calibrated units of the customer's choice are just some of those advantages. Permanent and easily reproduced records of signals from dc to 150 Hz can also be made on HP Oscillographs. From two to eight channels of recording can be made, depending upon the recorder model selected. The wide range of plug-in signal conditioning available for these recorders allows the customer to record dissimilar signals on the same chart paper.

The 7402A 2-channel ink recorder is unique in that it can also be used as a single channel recorder with a wide 100 mm trace. The 7404A 4-channel ink recorder can also be converted to a 2, or 3-channel recorder.

Applications

With appropriate signal conditioners, oscillographic recorders can record electrical signals from microvolts to volts. Add transducers and they can make records of all types of physical measurements such as force, position, strain, stress, acceleration, and temperature.

Oscillographs can also be used for troubleshooting since the chart paper can show real time correlation of a number of variables. The chart paper provides a historical record that can be used conveniently in reports.

Writing systems

Both ink and thermal writing systems are available. The 7402A 2-Channel and 7404 4-Channel recorders use ink. The 7414A 4-Channel and 7418A 6 and 8-Channel recorders use hot tip thermal writing techniques.

The ink writing system utilizes an ink that dries instantly to the touch, a low pressure ink system, and rugged stainless steel stylus with hard tungsten carbide tips.

Thermal writing systems utilize a hot tip stylus which is a major redesign of the heated stylus used on past HP thermal recorders. As a result, the reliability of the writing systems used in these recorders is vastly improved.

Oscillographic recorder system specifications

System	Number of Channels, Chart Width	Writing Method	Preamplifier Configuration	With Amplifier Model No.	Maximum Sensitivity (mV/div)	Response (−3 dB @ 10 div)	10% to 90% (ms, 10 div)
7402A	2 × 50 mm*	Ink	Plug-in		.001 1 20	125 Hz 140 Hz 140 Hz	7.5 (50 mm) 7 (50 mm) 7 (50 mm)
7404A	4 × 40 mm**	Ink	Plug-in			100 Hz 100 Hz 80 Hz	5 5 7
7414A	4 × 50 mm	Thermal	Plug-in	5 1 .001			
7418A	6 × 8 × 40 mm	Thermal	Plug-in/Bank				

*Single channel 100 ma operation standard.
**Dual channel 80 ma operation standard.

Signal conditioners — Plug-in preamps

A wide line of Plug-in Signal Conditioners is available for both ink and thermal recorders which provide unmatched flexibility for the recorder user.

Bank amplification

Two bank amplifiers are available for general purpose applications where economy is desired. They are used exclusively in the 7418 6- and 8-Channel recorder. Each Model 8820A low gain or 8821A medium gain is provided in 6- or 8-Channel versions.

3960A Instrumentation tape recorder

The H-P Model 3960A is a small-size, light-weight portable instrumentation tape recorder designed to perform in a large assortment of applications — data acquisition and data reproduction — formerly performed by large, expensive recorders. Portability is further enhanced by the capability of operating from either AC or DC power sources, a built-in DC calibrator, and peak AC/DC meter to facilitate any required prerecording adjustments.

Transport description

Designed to be rugged, as well as portable, the 3960A encompasses engineering design techniques to ensure it will perform like the large sophisticated and expensive instrumentation tape recorder. All tape drive assemblies are mounted on a solid aluminum casting. The tape guides and the Record/Reproduce heads are mounted on the capstan motor subassembly. This subassembly is then mounted on the solid aluminum casting assuring a permanent tape path alignment.

Data electronics

Data electronics are selected by opting for Direct recording when a wide passband is required or FM recording where higher SNR or DC response is needed. Four channels of data electronics, with up to a 16:1 time base expansion or contraction are available.

Both Direct and FM electronics can be used simultaneously in any desired combination for the four data channels. Located on the front panel of the transport assembly are the input sensitivity and output level controls plus the input and output BNC connectors. A systems connector for data input and output is also located on the back of the transport assembly to facilitate wiring when the instrument is rack mounted.

Other features

An optional Voice Amplifier permits voice annotating of data for locating specific test data during playback. Other options such as the Tape Speed Servo and Tape Loop Adapter may be chosen to enhance the 3960 capability for many diversified applications.

The 17400 Series of Plug-in Signal Conditioners is used in the 7420A 2-Channel and 7404A 4-Channel ink recorders.

Model No.	Description	Max Sensitivity
17400A	High Gain D.C.	1 μV/div differential, floated and guarded. Cal zero suppression.
17401A	Medium Gain D.C.	1 mV/div balanced to ground. Option 001 adds Cal zero suppression.
17402A	Low Gain D.C.	20 mV/div single ended.
17403A	A.C. Carrier	Internal Excitation (2.4 kHz) for passive transducers such as strain gage and differential transformers. Cal zero suppression. Differential floating inputs.

The 8800 Series of Plug-in Signal Conditioners are used in the 7414A 4-Channel and 7418A 6- and 8-Channel ink recorders.

Model No.	Description	Max Sensitivity
8801A	Low Gain D.C.	5 mV/div Differential Inputs. Cal Zero Suppression.
8802A	Medium Gain D.C.	1 mV/div Differential Inputs. Cal Zero Suppression.
8803A	High Gain D.C.	1 V/div Guarded floating input. Cal Zero Suppression.
8805A	A.C. Carrier	Internal Excitation (2.4 kHz) for passive transducers such as strain gages and differential transformers. Cal Zero Suppression.
8805B	A.C. Carrier	Same as 8805A, adds quadrature signal balance, signal averaging capability and internal calibration.
8806B	Phase Sensitive Demodulator	0.5 mV rms/div High impedance, transforms isolated inputs.
8807A	AC to DC Converter	50 Hz to 100 kHz 1 mV/div Average responding.
8808A	Log Level	100 dB Span 5 Hz to 100 kHz 1 dB accuracy 100 μV sensitivity.
8809A	Signal Coupler	1.5 V (1 mA into 1.5 kΩ) for Full Scale Deflection.

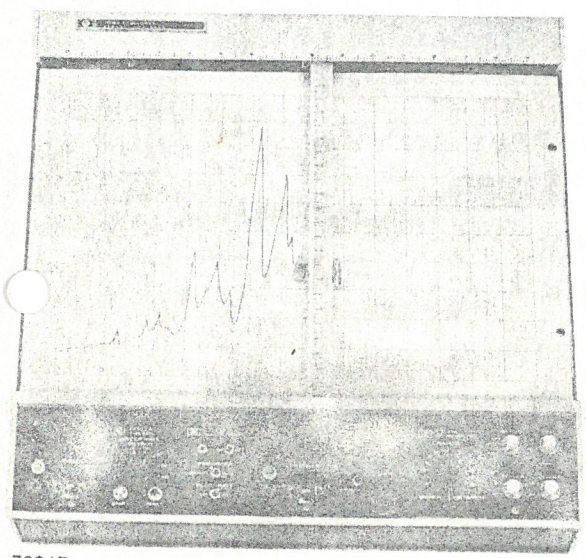
Zet. 2

RECORDERS & PRINTERS

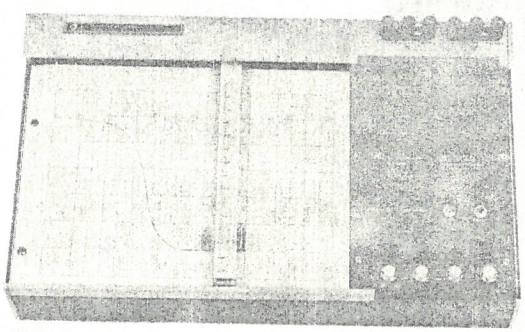
Fast response X-Y recorder, plug-in-modules

Models 7004B & 7034A

- High performance
- Plug-in versatility



7004B



7034A

The 7004B and the 7034A meet the constantly changing requirements of laboratory measurements. Plug-in modules and a variety of accessories form a versatile high performance X-Y Recorder. Circuitry, common to all plug-in modules (power supplies, interfaces, etc.), is located in the main frame. This allows the user to purchase additional low cost modules to expand the measurement capabilities of th[illegible]em.

With an acceleration of more than 3800 cm/s² (1500 in./s²) and slewing speed of 76 cm/s (30 in./s) the 7004B and 7034A record more phenomena than earier X-Y Recorders. The high acceleration allows the pen to follow small, quick input changes.

Front and rear guard terminals are available for signal inputs. Guarding helps eliminate the common mode voltage effects that are troublesome when recording from low-level sources such as thermocouples, strain gauges, and similar sources.

Additional features include the proven Autogrip electrostatic paper holddown, the disposable ink pen that produces a clean, crisp, continuous trace, a RECORD/SETUP switch, knob locks, five-way binding posts, tilt stand, to name a few.

Selection of the plug-ins is dependent upon the type of X-Y recorder as well as purpose. Two plug-ins per axis are placed in the mainframe. Each may be used individually or in series by setting the front panel switch. A description of each follows:

7004B & 7034A Specifications

Performance specifications

Number of plug-ins: frame will accept the equivalent of four single-width plug-ins, two per axis.
Type of input: floating and guarded signal pair. Available at the front panel or at the rear connector.
Zero set: zero may be set ±1 full scale from zero index.
Zero check switches: pushbutton zero check switch in each axis allows verification of recorder's zero position without removal or shorting of the input signal.
Mainframe accuracy: ±0.2% of full scale.
Range vernier: lockable, covers 2.5 times range setting.
Slewing speed: more than 75 cm/s (30 in./s) independent of line voltage and frequency.
Acceleration: more than 3800 cm/s² (1500 in./s²).
Reference stability: better than 0.003%/°C.
Terminal based linearity: ±0.1% of full scale.
Resettability: ±0.05% of full scale.

General specifications

Paper holddown: Autogrip paper holddown grips charts of any size up to size of platen.
Pen lift: local and remote control (contact closure or TTL).
Dimensions: 7004B: 445 mm wide, 445 mm high, 121 mm deep, (17½" × 17½" × 4¾"). 7034A: 445 mm wide, 267 mm high 121 mm deep (17½" × 10½" × 4¾").
Weight: 7004B: Net, 12.7 kg (28 lb). Shipping, 14.1 kg (42 lb). 7034A: Net, 7.3 kg (16 lb). Shipping, 14.1 kg (31 lb).
Power: 115 or 230 volts ac ±10%, 50 to 400 Hz, approximately 85 VA (depending on the plug-ins used).

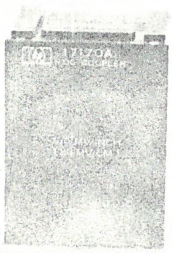
17170A DC coupler

The DC Coupler couples the input signal to the recorder mainframe. The input signal range of 50 mV/cm (100 mV/in.) may be adjusted to 125 mV/cm (250 mV/in.) with the recorder vernier control.

17170A Specifications

Input range: a single fixed calibrated range of 50 mV/cm (100 mV/in.).
Input resistance: constant, 1 MΩ.
Common-mode rejection: 120 dB at dc and 70 dB at 50 Hz and above with 100 ohms between low side and guard connection point with source impedance 10 kΩ or less.

Models 7004B & 7034A (cont.)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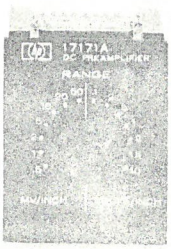
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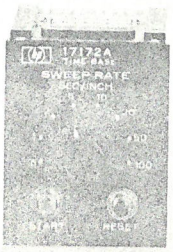
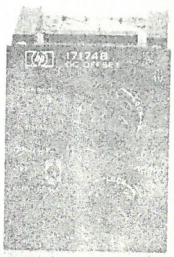

17172A


17173A


17174B

17171A DC amplifier

This plug-in is a stable, low noise dc amplifier. The 14 calibrated input ranges are supplemented by the recorder vernier control and provides a continuously variable range from 0.25 mV/cm (0.5 mV/in.) to 12.5 V/cm (25 V/in.).

17171A Specifications

Input ranges: Metric: 0.25, 0.5, 1, 2.5, 5, 10, 25 mV/cm, 0.05, 0.1, 0.25, 0.5, 1, 2.5, 5 V/cm. English: 0.5, 1, 2, 5, 10, 20, 50 mV/in., 0.1, 0.2, 0.5, 1, 2, 5, 10 V/in.
Input resistance: 1 MΩ.
Maximum allowable source resistance:

Range	Max. Source Resistance
0.25 mV/cm (0.5 mV/in.)	10 kΩ
0.5 mV/cm (1 mV/in.)	20 kΩ
1.0 mV/cm (2 mV/in.)	40 kΩ
2.5 mV/cm (5 mV/in.)	100 kΩ
5.0 mV/cm (10 mV/in.)	200 kΩ
10.0 mV/cm (20 mV/in.)	400 kΩ
25 mV/cm (50 mV/in.)	1 M

Common-mode rejection: 120 dB at dc and 100 dB at 50 Hz and above with 100 ohms between low side and guard connection point at 0.25 mV/cm (0.5 mVin.). On other ranges CMR decreases 20 dB per decade step in attenuation.
System accuracy: ±0.2% full scale.
Zero drift: 1 μV/C with a maximum of 25 μV from 0 to 50°C.

17172A Time base

Provisions for X-T or Y-T recordings are accomplished by this module. Standard features include eight speeds, automatic reset and pen lift at completion of sweep and remote start control. The vernier extends the sweep speed through 125 s/cm (250 s/in.).

17172A Specifications

Sweep speeds: Metric: 0.25, 0.5, 1, 2.5, 5, 10, 25, 50 s/cm; English: 0.5, 1, 2, 5, 10, 20, 50, 100 s/in.
System accuracy: ±1% of full scale on the six fastest ranges, ±2.5% on the remaining two ranges.
Terminal based linearity: ±0.5% of full scale.

17173A Null detector

Closed-loop plotting of data in point form, at up to 50 pps, is provided by the Null Detector. Plotting is accomplished with the 17012B/C Point Plotter which has a cable that plugs into the 17173A. Upon receipt of a seek signal and after the recorder reaches balance the 17173A commands the 17012B/C to plot and initiates a plot-complete pulse.

17173A Specifications

Plot rate: up to 50 plots/s.
Enable-disable: required disable voltage +3 volts minimum to +20 volts maximum. Required enable voltage: 0 V dc or no connection. Other voltage combinations available on request.
Muting: local or remote.
Plotting accuracy: ±0.25% of full scale.
Input: all inputs, except analog inputs, are available through rear input connectors in the module. Analog inputs are applied to the input terminals of the main frame. Mating connector supplied.

17174B DC offset

The recorder is provided with the capability of recording small signals superimposed on a steady-state dc voltage by the DC offset plug-in. The plug-in suppresses the steady-state dc voltage allowing recorder sensitivity to be increased.

17174B Specifications

Offset: less than 1 mV to approximately 1 volt.
Controls: two lockable, ten-turn high resolution controls (less than 1 mV to approximately 10 mV and less than 1 mV to approximately 1 V). An offset polarity switch allows upscale or downscale zero offset.
Offset voltage stability: greater than 0.005%/°C.
Insertion loss: less than 0.05%.

17175A Filter

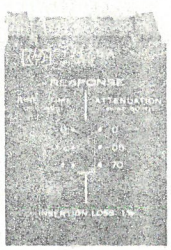
Rejecting ac input signal components is provided by the Filter. Insertion of the 17175A in front of any other signal conditioning input module will improve normal mode rejection.

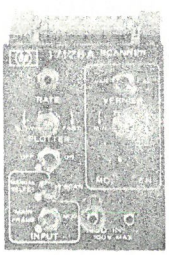
17175A Specifications

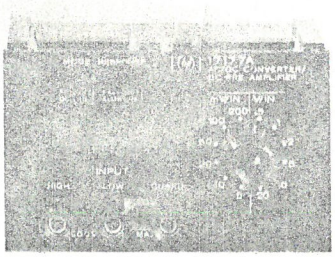
Input voltage range: −5 to +50 V dc, 10 V ac maximum peak-to-peak.
Maximum source impedance: 1 k, higher impedance decreases filter response.
Rejection: more than 55 dB at 50 Hz and higher (¼ s rise time) or more than 70 dB at 50 Hz and higher (1 s rise time). Front panel selectable.
Insertion loss: 1%; filter may be switched out with no change in insertion loss.

17176A Scanner

This plug-in electrically scans between two inputs, and provides the capability of plotting two dependent variables versus one independent variable. The Scanner, utilizing the 17012 B/C, can scan two selectable inputs (module or main frame) in two scan modes. The scan rate is adjustable from 0.1 s/scan to 4 s/scan.


17175A


17176A


17177A


17178A

17176A Specifications

Input: module input; front panel miniature binding posts isolated from ground (high and low only). Main frame input; utilizes existing input connectors on main frame.
Attentuator: fixed attenuator in decade steps from X1 to X0.001. Variable attenuator provides continuous coverage.
Input impedance: 100 kΩ.
Accuracy: 0.2% of full scale.
Scan rate: adjustable from 0.1 to 4 s/scan.

17177A AC/DC converter DC preamplifier

The ability to record both ac and dc signals is combined in the 17177A plug-in. The average-responding ac mode features an extremely flat frequency response from 5 Hz to 100 k Hz. This double-width module may be used in either axis.

17177A Specifications

Input ranges: 2.5 mV/cm to 10 V/cm (5 mV/in. to 20 V/in.) in 1, 2, 5, steps.
Minimum usable input (ac only): ±0.2% of full scale.
Maximum allowable input: 300 V peak.
Type of input: floating and guarded signal pair. Rear inputs not available.
Input impedance: 1 MΩ shunted by less than 40 pF.
Maximum allowable source resistance: 10Ω.
Common mode rejection: 80 dB at dc and 50 Hz and above with 100Ω between low side and guard connection point and at 2.5 mV/cm (5 mV/in.). On other ranges CMR decreases 20 dB per decade step in attenuation.
Rise/fall time (ac only, 10-90%):
Slow response (5 Hz to 100 kHz): 2.5 s maximum.
Fast response (50 Hz to 100 kHz): 0.5 s maximum.
Calibration (ac only): responds to average value of input waveform; calibrated in rms value of sine wave.
Accuracy (% of full scale):
dc: ±0.5%;
ac (fast response): ±0.25% from 150 Hz to 50 kHz, ±0.5% from 50 Hz to 150 Hz and 50 kHz to 100 kHz;
ac (slow response): ±0.25% from 30 Hz to 50 kHz from 5 Hz to 30 Hz and 50 kHz to 100 kHz.
Linearity (AC): expressed as % of full scale, measured from 0.5% of full scale.
Warm-up time: 3 minutes nominal.
Zero drift (referred to input): ±30 μV/°C.
Offset: up to one full scale of offset by use of recorder's zero.
Size: double width, occupies both plug-in spaces in axis.

17178A DC attenuator

A stable, passive attenuator with eight ranges is provided by the 17178A. The recorder vernier control allows continuously variable settings between fixed ranges of this module.

17178A Specifications

Input ranges: Metric: 0.05, 0.1, 0.25, 0.5, 1, 2.5, 5, 10 V/cm; English: 0.1, 0.2, 0.5, 1, 2, 5, 10, 20 V/in.
Input resistance: 1 MΩ.
Common-mode rejection: 120 dB at dc and 70 dB at 50 Hz and above with 100 ohms between low side and point where the guard is connected (at 50 mV/cm or 100 mV/in.). On other ranges CMR decreases 20 dB per decade step in attenuation.
System accuracy: ±0.2% of full scale.
Model number and name
7004B — 28.26 cm × 43.18 cm (11″ × 17″)
7034A — 21.59 cm × 28.26 cm (8½″ × 11″)
Option 001 — Metrically scaled and calibrated
Option 002 — X-axis retransmitting potentiometer, 5 kΩ ±0.1% linearity (7004B only)
Option 003 — Tank type pens (7004B only)
Option 004 — Power supply for 17005-04 incremental chart advance (7004B only)
17170A
17171A
Option 001 — Metrically scaled
17172A
Option 001 — Metrically scaled
17173A
Option 001 — +3 to +20 V enable, 0 V disable
Option 002 — −3 to −20 V disable, 0 V enable
Option 003 — −3 to −20 V enable, 0 V disable
17174B
17175A
17176A
17177A
Option 001 — Metrically scaled
17178A
Option 001 — Metrically scaled

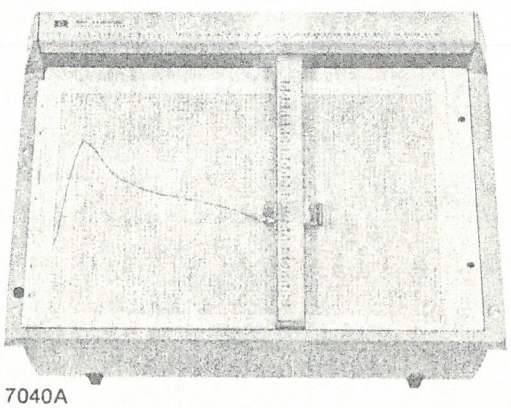
Zet. 3

RECORDERS & PRINTERS

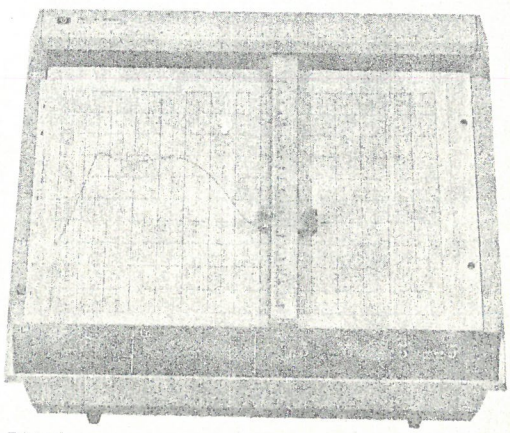
OEM, Dedicated applications X-Y recorders

Models 7040A & 7041A

- Rugged one-piece casting
- 42 standard options



7040A



7041A

The 7040A and 7041A X-Y recorders are specifically designed for dedicated, single-purpose recording applications. The 7040A is a medium-speed unit while the 7041A is a high-speed unit featuring fast acceleration for applications where recording time is critical or incoming data is at a high rate.

Both models use a one-piece aluminum casting mainframe which eliminates the need for critical mechanical adjustments. They are also equipped with the Autogrip paper holddown system and the quick-change disposable pen.

Additionally, over 40 options give these recorders the ability to be customized for the needed application. Most of the options can be easily and quickly installed or changed in the field. This includes a control panel (Option 038) which would provide the basic recorder functions such as zero set, servo, pen, and chart operation. Other options include a time base, a plug-in X-axis event marker, TTL logic remote control, plus a variety of input ranges.

A functional and quantity discount is available for both units when qualified for the OEM purchase agreement.

7040A & 7041A Specifications

Input ranges: single range from 0.2 to 500 mV/cm (0.5 mV/in. to 1 V/in.), specified by option choice.
Type of input: floating, 200 V dc or peak ac max; internal polarity switch; inputs through rear barrier strip or optional connector.
Input resistance: 1 mΩ constant.
Common mode rejection: 100 dB dc; 80 dB at line frequency.
Slewing speed:
7040A: 50 cm/s (20 in./s) min.
7041A: 75 cm/s (30 in./s) min.
Acceleration (peak):
7040A: Y axis 2540 cm/s² (1000 in./s²); X axis 1270 cm/s² (500 in./s²).
7041A: Y axis 7620 cm/s² (3000 in./s²); X axis 5080 cm/s² (2000 in./s²).
Accuracy: ±0.2% of full scale.
Sweep: optional, single range.
Zero set: external control provided by user; front panel controls available as Option 038.
Paper holddown: Autogrip electric paper holddown grips charts 279.4 × 431.8 mm (11″ × 17″) and international DIN A3 size or smaller.
Pen lift: electric pen lift controlled remotely by contact closure; TTL logic level provided by Option 039.
Dimensions: 356 mm high, 438 mm wide, 165 mm deep (14 × 19 × 6½″); rack mounting structure integral with unit.
Weight: Net, 13.2 kg (29 lb). Shipping, 16.8 kg (37 lb).
Power: 115 or 230 V ±10%, 50 to 400 Hz, approx. 130 VA.
Note: OEM discounts available on both models.

Options

Input range: specify one range option for each axis; must be both English or both metric

X	Y	Range	X	Y	Range
001	007	0.5 mV/in.	013	019	0.2 mV/cm
002	008	1 mV/in.	014	020	0.5 mV/cm
003	009	10 mV/in.	015	021	5 mV/cm
004	010	100 mV/in.	016	022	50 mV/cm
005	011	500 mV/in.	017	023	100 mV/cm
006	012	1 V/in.	018	024	500 mV/cm

Note: other ranges available on special order.

Sweep range: specified by option choice, X axis only; accuracy ±1% of full scale ±0.1%/°C max; TTL logic start and reset

	Sweep		Sweep
025	1 s/in.	030	0.5 s/cm
026	5 s/in.	031	1 s/cm
027	10 s/in.	032	5 s/cm
028	50 s/in.	033	10 s/cm
029	100 s/in.	034	50 s/cm

Note: other sweep ranges available on special order.

035: Event marker, upper margin of X axis
036: X axis retransmitting potentiometer (19.2 kΩ)
037: Y axis retransmitting potentiometer (13.1 kΩ)
038: Control panel; for line, pen lift, chart, servo standby, zero, and zero check; add 44 mm (1¾″) to height
039: TTL logic remote control; for pen lift and servo standby; also event marker if installed
040: Rear connector; X, Y input signals and retransmitting potentiometers, time base controls, Autogrip servo standby, pen lift, event marker and Option 039 control lines brought to a single locking connector
041: Side trim panels and dust cover (355.6 mm, [14″]) for standard unit
042: Side trim panels and dust cover (400.1 mm, [15¾″]) for unit with Option 038 installed

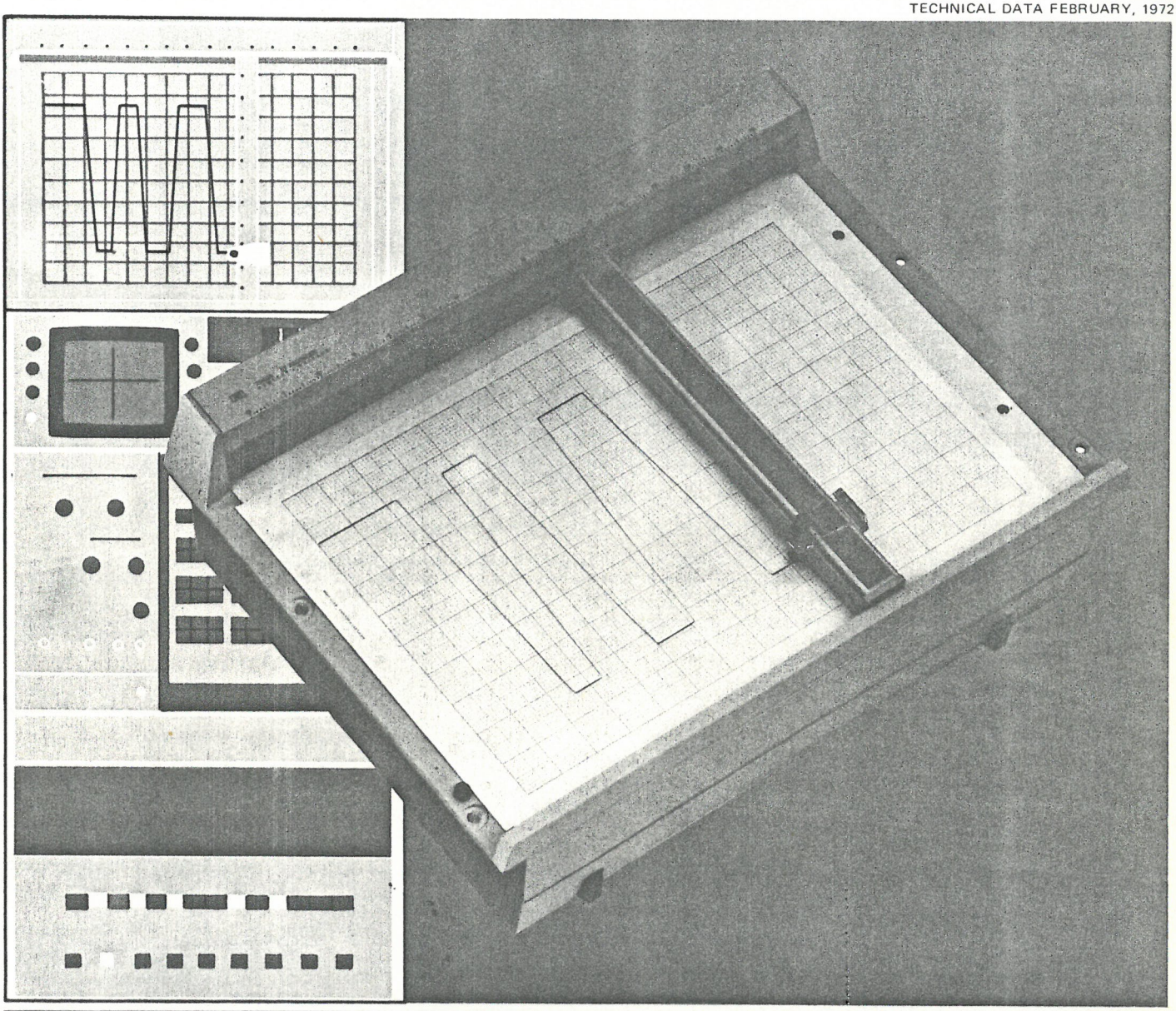
Model number and name
7040A Medium Speed X-Y Recorder
7041A High Speed X-Y Recorder

HEWLETT hp PACKARD

O.E.M. X-Y RECORDER
11 in. x 17 in. and A3

7040A
7041A

TECHNICAL DATA FEBRUARY, 1972

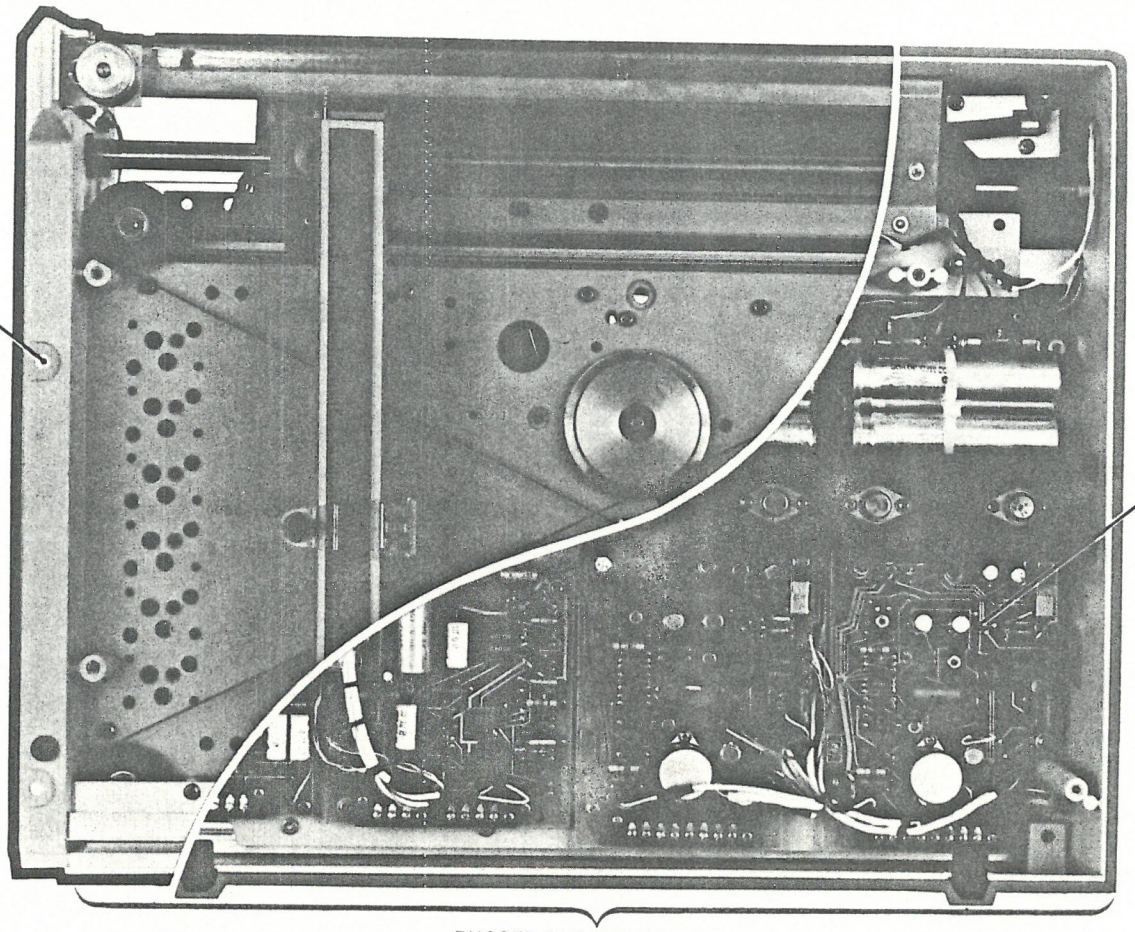


O.E.M. DISCOUNTS	**The Margin You Need as an O.E.M.**
FAST RESPONSE	**Faithfully Records The Input Signal.**
42 STANDARD OPTIONS	**Buy ONLY What You Need.**
DIE-CAST MAINFRAME	**Reliability Through Design Simplicity.**
TOUGH ENVIRONMENTAL SPECIFICATIONS	**Works Wherever Your System Goes.**

5952-2740
Printed in U.S.A.

THE 7040A AND 7041A ARE DESIGNED TO YOUR NEEDS

inside . . .



The Hewlett-Packard 7040A and 7041A X–Y Recorders are designed specifically for dedicated, single-purpose recording applications. The 7040A is a medium-speed unit while the 7041A is a high-speed unit featuring exceptionally fast acceleration. These units marry two major design concepts to become the world's first truly OEM X–Y Recorders—rugged units at quantity prices – quantity units with quality options.

First was the designing of a one piece aluminum casting mainframe. Costly to design and tool initially, this unique mainframe resulted in unexcelled rigidity and ruggedness. Misalignment, critical adjustments, and assembly errors became a thing of the past – the cost savings are passed on to the user.

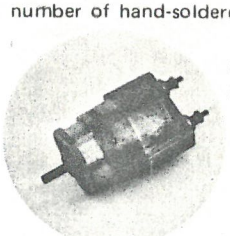
Second, these recorders have a new twist to an old manufacturing method. Instead of buying an instrument with features you don't need, buy only what you need. In short, this means these recorders are designed from the ground up as OEM instruments. You specify only those features you need – over 40 options are available to fit those specific needs. Here again is an evident cost saving compared to purchasing stripped-down laboratory recorders.

The net result is instruments in which reliability is gained through simplicity – and ruggedness is an obvious fact of design. And yet – they cost less. Truly, one of the few bargains around.

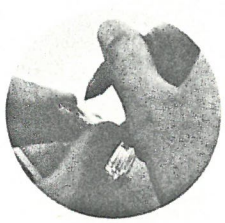
STANDARD FEATURES

Far from being stripped-down, you'll find all the user-oriented features on every 7040A and 7041A which have made HP the undisputed leader in X–Y Recorders. Things like the AUTOGRIP paper holddown system, which is silent, trouble-free (no moving parts), and which solidly grips any size paper up to 11 in. x 17 in. as well as the standard European A3 size. And not to be overlooked, is our quick-change disposable pen, which keeps ink on the paper, not on your hands.

There are plastic, infinite resolution, feedback potentiometers on both axes. Mounted close to the pen, they assure that linearity stays the same over the years. A new motor design, also used on both axes, allows the pen to be driven offscale for an infinite period of time without noise damage. Even in the electronic portion of the 7040A and 7041A, latest IC design and assembly techniques have reduced to only ten the number of hand-soldered connections.



Continuous duty motor

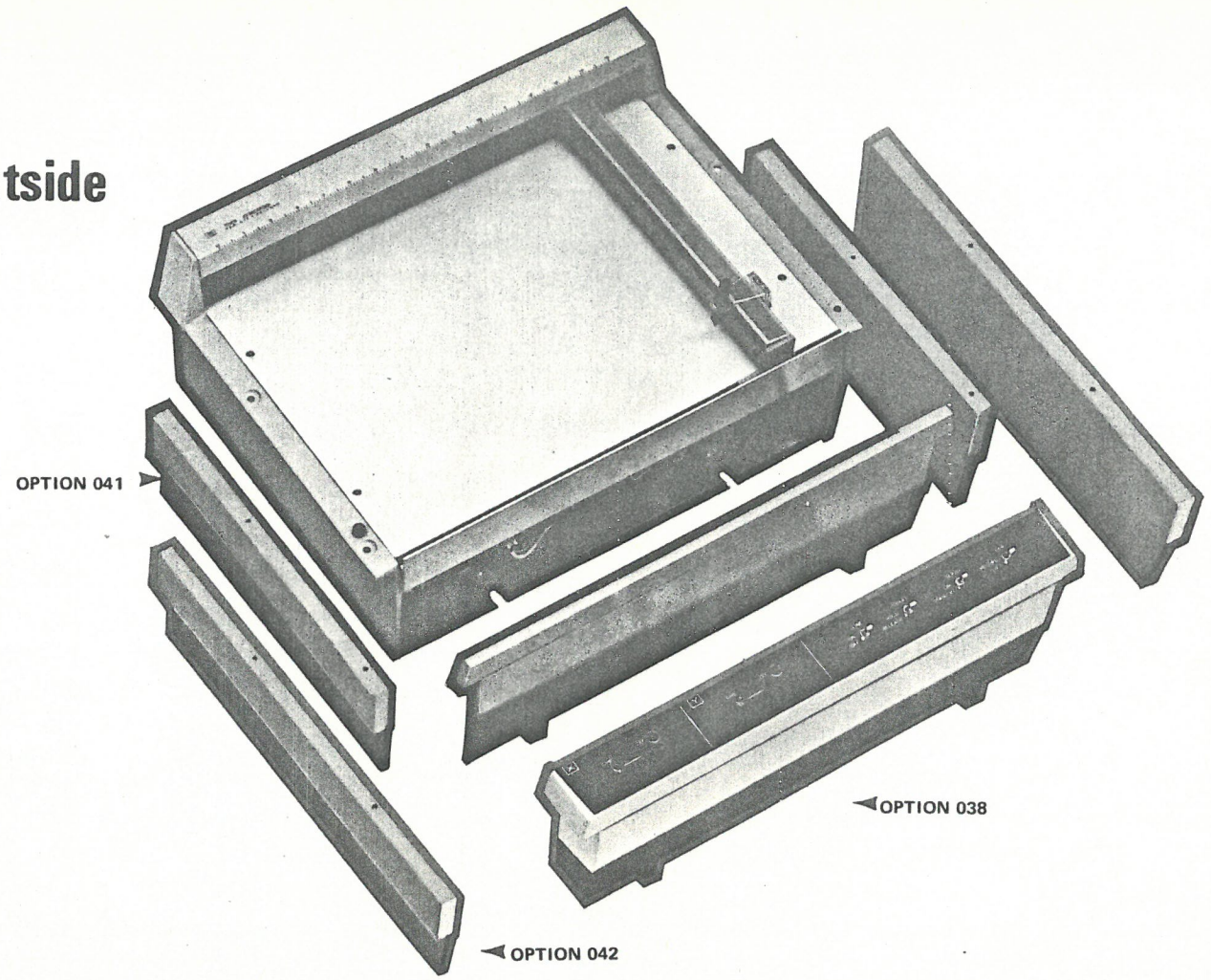


Quick change pens -clean to use

OPTIONS

The many options on the 7040A and 7041A provide the method for matching the recorder to your system. Start with a choice of English or metric scaling. Then pick from any of six calibrated ranges for the X and Y axes (any in-between range can be supplied on a low cost special order). You can also add on our Event Marker. It records in the top margin. Additionally, if you need a time base, TTL Logic, rear connector, or retransmitting potentiometers, we have these options available as well.

outside



SPECIFICATIONS OF THE MAINFRAME

PERFORMANCE SPECIFICATIONS

Input Ranges: Single range from 0.5 mV/in. thru 1 V/in. (0.2 mV/cm thru 500 mV/cm, specified by option choice.

Type of Input: Floating, 200 Vdc or peak ac maximum. Polarity reversal switch provided on amplifier circuit board. Inputs thru rear barrier strip or optional connector.

Input Resistance: 1 megohm constant.

Common Mode Rejection: 100 dB dc, 80 dB at line frequency.

Slewing Speed: 7040A – 20 in./sec (50 cm/sec) minimum.
7041A – 30 in./sec (76 cm/sec) minimum.

Acceleration (Peak): 7040A–Y axis 1000 in./sec^2 (2540 cm/sec^2), X axis 500 in./sec^2 (1270 cm/sec^2). 7041A–Y axis 3000 in./sec^2 (7620 cm/sec^2), X axis 2000 in./sec^2 (5080 cm/sec^2).

Accuracy: ±0.2% of full scale.

Linearity (Terminal Based): ±0.1% of full scale.

Resettability: 0.1% of full scale.

Overshoot: 2% of full scale (maximum).

Zero Set: External controls provided by user. Basic front panel controls available with Option 038.

GENERAL SPECIFICATIONS

Writing Mechanism: Servo actuated ink pen.

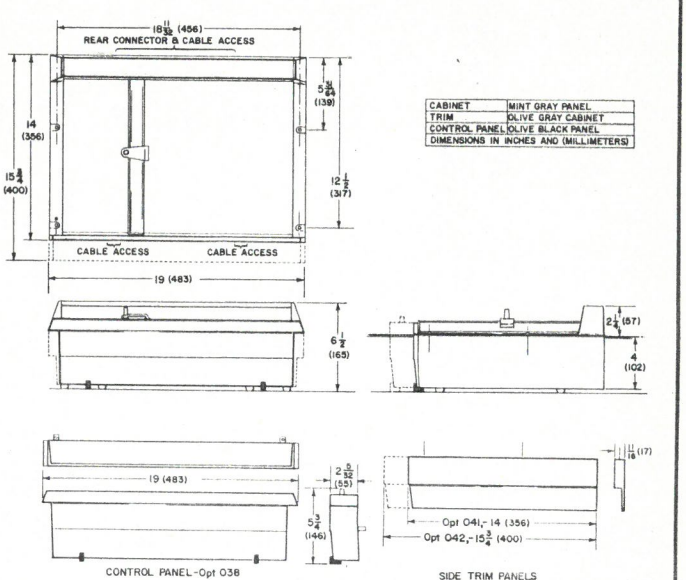
Writing Area: 10 in. X 15 in. (25 cm X 38 cm).

Paper Holddown: Autogrip electric paper holddown grips charts 11 in. X 16.5 in. and standard European size A3 (29.7 cm X 42 cm) or smaller. Special paper not required.

Pen Lift: Electric pen lift controlled remotely by contact closure to ground. TTL logic levels for control available in Option 039.

Power: 115 or 230 volts ac ± 10%, 50 to 400 Hz, 175 VA.

Weight: Net, 29 lb (13.2 kg); shipping 37 lb (16.8 kg).



CABINET	MINT GRAY PANEL
TRIM	OLIVE GRAY CABINET
CONTROL PANEL	OLIVE BLACK PANEL

DIMENSIONS IN INCHES AND (MILLIMETERS)

OPTIONS

■ RANGE OPTIONS

Either single voltage range or single voltage range and single sweep range must be specified for X axis. Single voltage range must be specified for Y axis. Choices must be either all English or all metric.

VOLTAGE RANGE

Voltage	Option X	Option Y	Voltage	Option X	Option Y
0.5 mV/in.	001	007	0.2 mV/cm	013	019
1 mV/in.	002	008	0.5 mV/cm	014	020
10 mV/in.	003	009	5 mV/cm	015	021
100 mV/in.	004	010	50 mV/cm	016	022
500 mV/in.	005	011	100 mV/cm	017	023
1 V/in.	006	012	500 mV/cm	018	024

SWEEP RANGE

Sweep Rates: Single rate from 1 thru 100 sec/in. (0.5 thru 50 sec/cm), specified by option choice. X axis only.

Accuracy: ±1% of full scale at 25° C (±0.1%/°C maximum)

Linearity: ±0.5% of full scale at 25° C (±0.04%/°C maximum)

Controls: Sweep start and reset actuated by momentary contact closure to ground or TTL logic levels. Recycle accomplished by continuous start signal. Automatic reset at full scale.

Sweep	Option	Sweep	Option
1 sec/inch	025	0.5 sec/cm	030
5 sec/inch	026	1 sec/cm	031
10 sec/inch	027	5 sec/cm	032
50 sec/inch	028	10 sec/cm	033
100 sec/inch	029	50 sec/cm	034

■ EVENT MARKER — OPTION 035

Marking Area: Upper margin, aligned with X-axis position.
Excursion: Approximately 0.05 in. (0.13 cm)
Ink Capacity: 0.77 cc cartridge.
Control: Controlled remotely by contact closure to ground. TTL logic levels for control available in Option 039.

■ RETRANSMITTING POTENTIOMETER (X–AXIS) — OPTION 036

RETRANSMITTING POTENTIOMETER (Y–AXIS) — OPTION 037

Resistance: 19.2 k ohms ±10% (X-axis).
13.1 k ohms ±10% (Y-axis).
Linearity: ±0.1% of full scale (terminal based).
Contact Resistance: 4 k ohms (maximum).

■ CONTROL PANEL — OPTION 038

Zero Set: Zero may be placed anywhere on the writing area. Adjustable by a ten-turn, high resolution control.
Controls: Line, Pen Lift, Chart, Servo Standby, Zero, and Zero Check.

■ TTL LOGIC LEVEL REMOTE CONTROL — OPTION 039

Operating Levels: Contact closure (0.2 mA) to ground or TTL logic levels.

Controls: Allows remote control of pen lift, servo standby, and event marker (if installed).

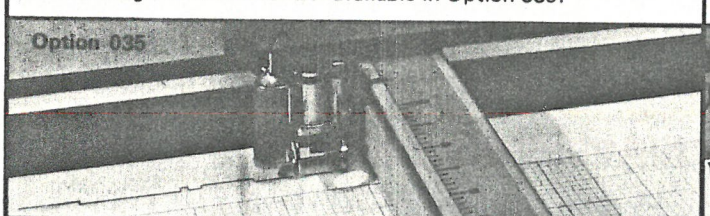
■ REAR CONNECTOR — OPTION 040

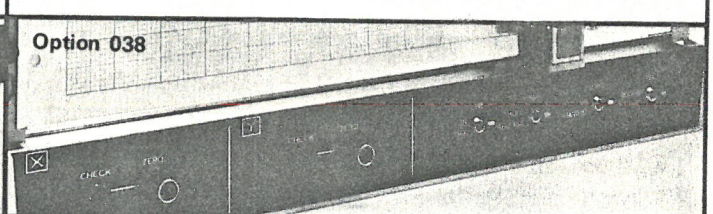
Purpose: Connects the various rear terminal strip connections to a single rear locking connector. Allows quick connect/disconnect.
Connections: X and Y input signals, zero controls, Autogrip, servo standby, pen lift, event marker, X and Y retransmitting potentiometer, time base controls, and Option 039 control lines.

■ SIDE TRIM PANELS (TWO 14 IN.) — OPTION 041

USE WITH OPT. 038 (TWO 15.75 IN.) — OPTION 042

Purpose: Side trim panels are intended for table top applications where additional appearance trim is desired. Includes flexible plastic dust cover.





SUPPLIES (See Servo Recorder Supplies Data Sheet for complete listing)

ACCESSORIES SUPPLIED

1. Accessory Kit, part number 07040-60630.
   Cleaner
   Lubricant
   Three disposable cartridge pens, blue
   Three disposable cartridge pens, red
2. Graph paper, 10 sheets each, heavy and light.

DISPOSABLE PENS:

Description	Part Number
Red	5081-1190
Blue	5081-1191
Green	5081-1192
Black	5081-1193

SUPPLIES

Paper: All recording papers offered by Hewlett-Packard are manufactured to stringent specifications. Accuracy of margins and of cross-sections is very closely controlled. The highest quality of paper is used to minimize dimensional changes that occur with changes in temperature and humidity. Ideal recording results are achieved at approximately 50% relative humidity.

Type	Grid Description X	Grid Description Y	Weight	Part No. (100 Sheet Box)
Linear, English (11 in. X 16.5 in.)	15 major div (1 in. each)	10 major div (1 in. each)	Light	9270-1005
			Heavy	9270-1004
Linear, Metric (28 cm X 41.9 cm)	38 major div (1 cm each)	25 major div (1 cm each)	Light	9270-1042
			Heavy	9270-1024

For more information, call your local HP Sales Office or write Hewlett-Packard: In US, 1501 Page Mill Road, Palo Alto, California 94304. In Canada, 275 Hymus Blvd., Pointe Claire. In Europe, 1217 Meyrin-Geneva. Other areas, INTERCONTINENTAL, 3200 Hillview Ave., Palo Alto, California 94304.

NEW

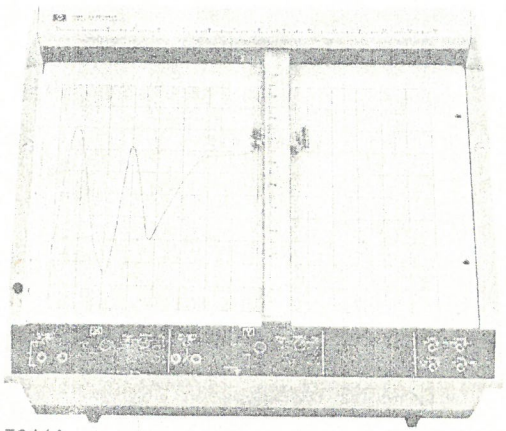
RECORDERS & PRINTERS

High performance X-Y recorders

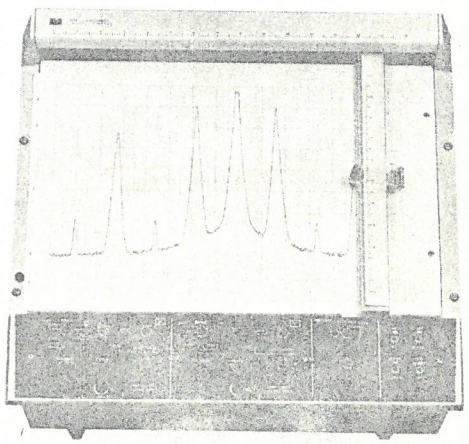
Models 7044A, 7045A, & 7047A

Zst. 4

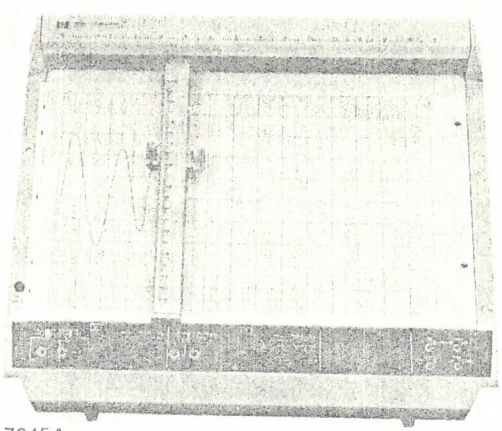
- High dynamic response
- Tough environmental specifications



7044A



7047A



7045A

The Models 7044A, 7045A, and the 7047A are general purpose X-Y recorders specifically designed to offer the needed requirements to perform laboratory measurements. This allows for a wide range of quick-changing signals to be reproduced accurately and dependably. The 7044A is a medium-speed recorder designed for most general-purpose applications. The 7045A and 7047A offer higher speed and Y-axis acceleration exceeding 7620 cm/sec² (3000 in./sec²).

Other outstanding features found on the recorders include 10 calibrated dc input ranges on each axis of the 7044A and 7045A from 0.25 mV/cm to 5 V/cm (0.5 mV/in. to 20 V/in.) and 12 calibrated dc input ranges on each axis of the 7047A from 0.02 mV/cm to 5 V/cm (0.05 mV/in. to 10 V/in.). In between, a 1-5-10 sequence is used (except for the 0.02 mV/cm, most sensitive range setting on the metric option) on the 7047A. On all three, arbitrary full scale voltage ranges may be established with the vernier control in conjunction with the calibrated dc ranges.

Additionally, these recorders are equipped with front panel polarity switches which reverse pen direction, eliminating the need for reversing the input leads. The 7045A and 7047A are provided with a RESPONSE switch which allows the user to slow the response of the recorder for easier setup. The 7047A preamplifiers for the X and Y axes are contained in two specially designed aluminum enclosures. These contain chopper dc amplifiers and have the unique serviceability feature of being removable and operational outside of the mainframe, using the cable extender included in the Accessory Kit.

Also available on all models is the continuous duty, aluminum framed dc servo motor; the X-axis of the 7045A and 7047A contain the larger, faster motor. This ends overheating or wear if the pen is driven offscale for an indefinite time. The trouble-free Autogrip electrostatic holddown platen capable of holding chart paper of the European size A3 and 11 in. × 17 in. size is included, as well as a disposable pen with four color choices, and plastic coated wirewound balance potentiometer. Latest circuitry design and assembly techniques have also been incorporated, thereby reducing failure and maintenance time.

Options include the Time Base (standard on the 7047A) Event Marker and Metric Scaling. TTL Remote Control and Rear Connector are standard on all models.

7044A, 7045A Specifications

Performance specifications

Input ranges: 0.25, 0.5, 2.5, 5, 25 mV/cm; 0.05, 0.25, 0.5, 2.5, 5 V/cm (English calibration available in 0.5, 1, 5, 10, 50 mV/in.; 0.1, 0.5, 1, 5, 10 V/in.). Continuous vernier between ranges.

NEW

Type of input: floating, 500 V dc or peak ac maximum. Polarity reversal switch located on front panel, guard internally connected. Inputs through front panel 5-way binding posts or rear connector.
Input resistance: 1 megohm constant on all ranges.
Common mode: 110 dB dc and 90 dB at 50 Hz and above (exceeds 120 dB dc and 110 dB ac under normal lab environmental conditions) with 1 kΩ between HI and LO terminals, CMR voltage applied between ground and LO, and attenuator on most sensitive range. CMR decreases 20 dB per decade step in attenuation.
Slewing speed:
7044A: 50 cm/sec (20 in./sec) minimum.
7045A: Fast Response, 76 cm/sec (30 in./sec) minimum. Slow Response, 36 cm/sec (15 in./sec) typical.
Acceleration (peak):
7044A: Y-axis 2540 cm/sec² (1000 in./sec²), X-axis 1270 cm/sec² (500 in./sec²).
7045A: (Fast Response only) Y-axis 7620 cm/sec² (3000 in./sec²). X-axis 5080 cm/sec² (2000 in./sec²).
Accuracy: ±0.2% of full scale (includes linearity and deadband) at 25°C. Temp Coefficient ±0.01% per °C.
Range Accuracy: ±0.2% of full scale ±0.2% of deflection (includes linearity and deadband) at 25°C. Temp Coefficient ±0.01% per °C.
Deadband: 0.1% of full scale.
Overshoot: 7044A — 2% of full scale (maximum). 7045A — 1% of full scale (maximum).
Zero set: zero may be placed anywhere on the writing area or electrically off scale up to one full scale from zero index.
Environmental (operating): 0° to 55°C and <95% relative humidity (40°C).

General specifications

Writing mechanism: servo actuated ink pen.
Writing area: 25 cm × 38 cm (10″ × 15″).
Paper holddown: Autogrip electric paper holddown grips chart 29.7 cm × 42 cm (European size A3) and 11″ × 16.5″ or smaller. Special paper not required.
Pen lift: electric.
Dimensions: 400 mm high, 483 mm wide, 165 mm deep (15¾″ × 19″ × 6½″); rack mounting structure integral with unit.
Power: 115 or 230 V ac ±10%, 50 to 400 Hz; 7044A, 135 VA; 7045A, 175 VA.
Weight: Net, 13.7 kg (30 lb). Shipping, 19.1 kg (42 lb).

Options

006: Metric Calibration
001: Time Base
Sweep rates: 0.25, 0.5, 2.5, 5, 25, 50 sec/cm (0.5, 1, 5, 10, 50, 100 sec/in.).
Time Base Accuracy: 1.0% at 25°C.
Temp Coefficient ±0.1% per °C.
General: Switchable to either X or Y axis. Start and reset by front panel control, remote by momentary contact closure to ground or TTL levels. Automatic reset at full scale, recycle accomplished by continuous start signal.
002: Event Marker: Writes in upper margin, aligned with X-axis position, approximately 0.13 cm (0.05 in.) excursion completed 50 msec after application of signal. Controlled remotely by contact closure to ground or by TTL levels.

7047A Specifications

Performance specifications

Input ranges: 0.02, 0.05, 0.1, 0.5, 1, 5 mV/cm; 0.01, 0.05, 0.1, 0.5, 1, 5 V/cm (0.05, 0.1, 0.5, 1, 5, 10 mV/in.; 0.05, 0.1, 0.5, 1, 5, 10 V/in.) Continuous vernier between ranges.
Type of input: Differential, floating, and guarded (front input only). Employs a unique common mode driver circuit that eliminates the need for connecting CMV to the recorder if CMV is less than or equal to 10 V.
Input resistance: 1 megohm constant on all ranges.
Accuracy: ±0.2% of full scale (includes linearity and deadband) at 25°C. Temp Coefficient ±0.01% per °C.
Range accuracy: ±0.2% of full scale ±0.2% of deflection (includes linearity and deadband) at 25°C. Temp Coefficient ±0.01% per °C.
Deadband: 0.1% of full scale.
Common mode rejection: 140 dB and 130 dB ac with 1 KΩ imbalance in either the high or low terminal — exceeds 150 dB and 140 dB ac under normal laboratory conditions. CMR decreases 20 dB per decade step in attenuation.
Normal mode rejection: 30 dB minimum at line frequency with FILTER IN. (50 dB typical at 60 Hz and 40 dB typical at 50 Hz).
Slewing speed: 76 cm/second (30 in./sec) minimum. 97 cm/sec (38 in./sec) typical under normal lab conditions.
Acceleration (peak): Y-axis 7620 cm/sec² (3000 in./sec²)
X-axis 5080 cm/sec² (2000 in./sec²)
Overshoot: 1% of full scale maximum.
Calibrated zero offset: Provides eleven scales of calibrated zero offset in both axes. Switchable in steps of one full scale from +1 to −10 scales.
Offset accuracy: At 25°C, ±0.1% of full scale times N where N = number of scales of offset.
Temperature coefficient: ±0.004% of full scale times N per °C.
Time base: Speeds of 0.1, 0.5, 1, 5, 10, 50 sec/cm (0.5, 1, 5, 10, 50, 100 seconds/in.). Switchable into X or Y axis.
Time base accuracy: 1.0% at 25°C. Temp Coefficient ±0.1% per °C.

General specifications

Writing mechanism: servo actuated ink pen.
Writing area: 25 cm × 38 cm (10 in. × 15 in.).
Paper holddown: Autogrip electric paper holddown grips charts 25 × 38 cm (11 × 16.5 in.) and standard European size DIN A3, or smaller. Special paper not required.
Pen lift: Electric (remote via TLL level).
Power: 115 or 230 V ac ±10%, 48 to 66 Hz, 180 VA maximum.
Weight: Net, 18.6 kg (41 lb). Shipping, 24 kg (53 lb).

Metric calibration — option 001

Ranges are 0.02, 0.05, 0.10, 0.50, 1, 5 mV/cm; 0.01, 0.05, 0.1, 0.5, 1, 5 V/cm.

Event marker — option 002

Marking area: In margin at same X coordinate as recorder pen.
Excursion: Approximately 0.050 inch.
Actuation time: Stroke complete 50 ms after application of signal.
Ink capacity: 0.45 cc cartridge, cartridge reloading type. Writing distance 500 ft minimum.

Model number and name
7044A
7045A
7047A

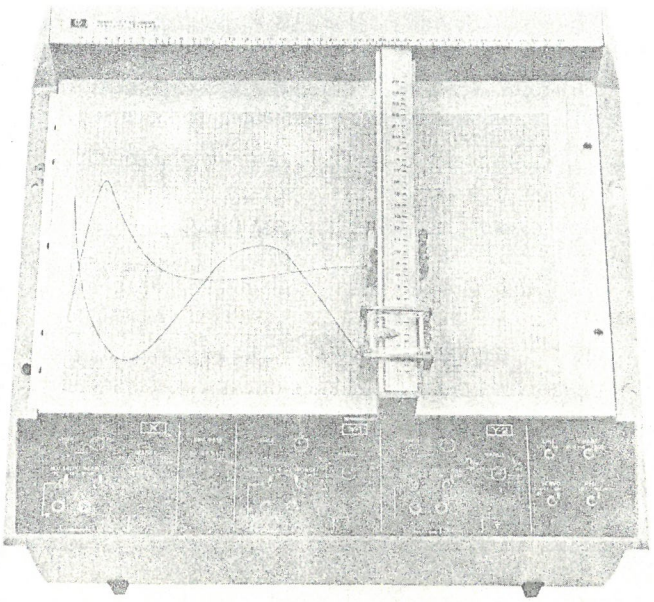
RECORDERS & PRINTERS

Two-pen, three parameter X-Y/Y recorder

Model 7046A

Zst. 5

- Small pen separation
- Virtually no overshoot



The Model 7046A is a general-purpose 2-pen laboratory X-Y recorder designed to assure high quality recordings without sacrificing ruggedness, reliability and high performance so necessary for a laboratory recorder. The unit has dynamic performance that surpasses most 2-pen recorders by offering Y-axis acceleration exceeding 6350 cm/s² (2500 in./sec²). This high acceleration plus very little overshoot results in the 7046A reproducing a wide range of fast changing input signals.

New thin line disposable pens that feature a visible ink supply and have a trace separation of 1.2 mm (0.05 in.) are provided. These pens, available in three colors, produce good clean traces. A front panel polarity switch that switches pen direction, and the response switch which reduces the speed of the unit, are also available. The Autogrip paper holddown system which holds up to 27.9 cm × 43.2 cm (11 × 17 in.) and standard European DIN A3 size paper is also standard.

7046A Specifications

Performance specifications

Input ranges: metric calibration available in 0.25, 0.5, 2.5, 5, 25 mV/cm; 0.05, 0.25, 0.5, 2.5, 5 V/cm (0.5, 1, 5, 10, 50 mV/in.; 0.1, 0.5, 1, 5, 10 V/in.). Continuous vernier between ranges.

Type of input: floating, 500 V dc or peak ac maximum. Polarity reversal switch located on front panel, guard internally connected. Inputs through front panel binding posts or rear connector.

Input resistance: 1 megohm constant on all ranges.

Common mode: 110 dB dc and 90 dB at 50 Hz and above exceeds 130 dB dc and 110 dB ac under normal lab environmental conditions) with 1 k ohm between HI and LO terminals, CMR voltage applied between ground and LO, and attenuator on most sensitive range. On other ranges, CMR decreases 20 dB per decade step in attenuation.

Slewing speed: Fast Response, 76 cm/s (30 in./s) minimum; Slow Response, 36 cm/s (15 in./s) typical.

Acceleration (peak, fast response only): Y-axis 6350 cm/s² (2500 in./s²), X-axis 3800 cm/s² (1500 in./s²).

Accuracy: ±0.2% of full scale (includes linearity and deadband) at 25°C. Temp Coefficient ±0.01% per °C.

Range accuracy: ±0.2% of full scale ±0.2% of deflection (includes linearity and deadband) at 25°C. Temp Coefficient ±0.01% per °C.

Deadband: 0.1% of full scale.

Overshoot: 1% of full scale (maximum).

Zero set: zero may be placed anywhere on the writing area or electrically off scale up to one full scale from zero index.

Environmental (operating): 0 to 55°C and <95% relative humidity (40°C).

General specifications

Writing mechanism: servo actuated ink pens, offset by 0.12 cm (0.05 in.) in X direction.

Writing area: 25 cm × 38 cm (10″ × 15″).

Paper holddown: Autogrip electric holddown grips charts on standard European DIN A3 or smaller and 11″ × 16.5″. Special paper not required.

Pen lift: electric (remote, via contact closure or TTL level).

Dimensions: 441 mm high, 483 mm wide, 173 mm deep (17⅜″ × 19″ × 6¹³⁄₁₆″); rack mounting structure integral with unit.

Power: 115 or 230 volts ac ±10%, 50 to 400 Hz, 175 VA.

Weight: net, 16 kg (35 lb); shipping, 21.4 kg (47 lb).

Options

007: Metric Calibration

001: Time Base

Sweep rates: Metric calibration is 0.25, 0.5, 2.5, 5, 25, 50 s/cm (0.5, 1, 5, 10, 50, 100 s/in.).

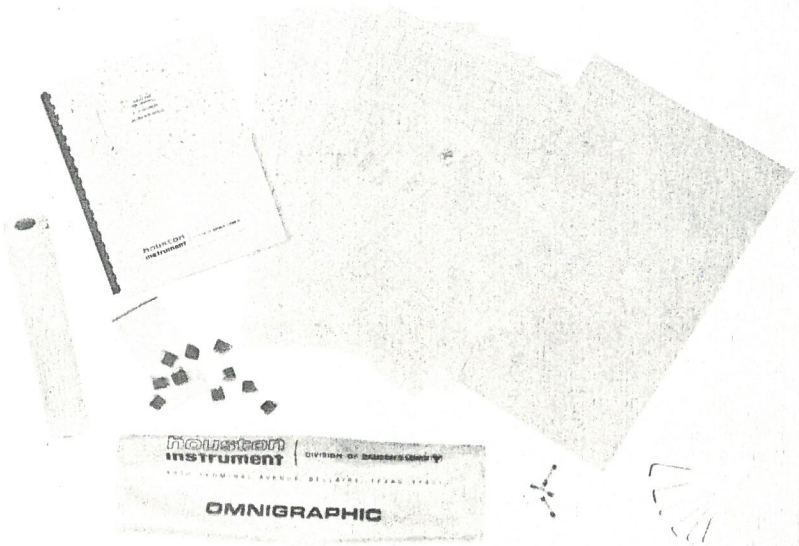
Accuracy: ±1% at 25°C (±0.1%/°C maximum).

General: switchable to X-axis. Start and reset by front panel control, remote by momentary contact closure to ground or TTL levels. Automatic reset at full scale, recycle accomplished by continuous start signal.

002: Event Marker

Writes in upper margin, aligned with X-axis position of Y pen, approximately 0.12 cm (0.05 in.) excursion completed 50 ms after application of signal. Controlled remotely by contact closure to ground or by TTL levels. Contact resistance: 4 kΩ (maximum).

Zet. 6



STANDARD ACCESSORIES SUPPLIED

- Instruction Manual
- Dust Cover – Flexible
- Sample Graph Paper (10 sheets) (2000)
- Roll Chart Paper (3000)
- Accessory Kit containing:
  - 5 Red Pens
  - 5 Black Pens
  - 3 Fuses
  - Set Bristol Wrenches
- 8½ X 11 (or A4) Shield (2000)

Warranty

Houston Instrument warrants unconditionally for 1 year from date of shipment each instrument manufactured by it to be free from defects in material and workmanship. Its liability under this warranty is limited to servicing or adjusting any instrument returned by the original purchaser to the factory for that purpose and to replace any defective parts therein.

REPRESENTED BY

houston instrument | DIVISION OF BAUSCH & LOMB

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(512) 837–2820 TWX 910–874–2022 cable HOINCO

EUROPEAN OFFICE Rochesterlaan 6 8240 Gistel Belgium
Phone 059/27445 Telex Bausch 19399

"the recorder company"

Bulletin 2 & 3 1074

Printed in USA

OUTSTANDING FEATURES

2000 X–Y
3000 STRIP CHART

DIFFERENTIAL INPUT: Measures from any type of source up to ±500 volts from ground. Isolation and common mode rejection are so good that shields and guards are not needed.

MOUNTING: Bench, Rack or Panel in vertical or horizontal planes.

ZERO CHECK POSITION: A standard feature on most modules. Without disconnecting the signal, zero position can be verified and scaled.

ALL SOLID STATE: State of the art IC's. No mechanical or light diode choppers. No tubes or nuvistors. No warm-up for calibrated operation.

CONSTRUCTION: Case and modules are unbreakable, mar resistant ABS black plastic, with a textured surface. This instrument will look new for years. It is not susceptible to nicks and scratches. Interior frame is injection cast aluminum. All other parts are plastic, stainless steel or anodized aluminum.

GEAR COMPENSATING MECHANISM: State of the art design eliminates adjustment. Cleanliness is desired, but not essential. No lubrication ever.

INCH/CENTIMETER SCALING: Front panel switch, on modules, allows calibration of recorder in inches or centimeters, as related to the paper grid.

ACCESS: Sides, bottom and top are removable in seconds for complete access to any portion – either individually or completely.

PEN LIFT: Electric with positive action. Failsafe on power failures. Local and remote control via isolated contact closure.

PENS: A constant line trace regardless of speed or use. Snap on, disposable unit includes pen tip and ink. No need ever for complicated cleaning procedures or overnight plugging. Pens will write after weeks unused. Capillary ink pen option.

OVERSHOOT: Not discernible on normal step inputs. Less than 1% on full scale step inputs.

HIGH PERMISSIBLE SOURCE RESISTANCE: As sources approach and exceed the 10^5 ohms domain, neither dead zone nor repeatability is affected; common mode and frequency response only mildly; calibration normally.

VERSATILITY: Laboratory or field, production or process, OEM or dedicated – all are ideal for this recorder. The completely self contained frame stands alone, but can act as the basic building block for the modules. There is no duplication in circuitry. The design is so basic that no part contains a premium capability.

SEALED REBALANCE POTENTIOMETERS: No cleaning ever, with extended life. Recorder uses its own limit stops and a friction clutch to give added protection to the pot and the entire mechanics.

INPUT MODULES: Plug-in modules give choice of function and cost. Each gives front panel and remote control. All units plug-in and are interchangeable in moments. Most modules even work in the related X–Y, Strip Chart, and TY® Recorders.

MODULE CONTROLS: Logically placed for unthinking use. Each control is always in the same place, regardless of module type.

DYNAMIC PERFORMANCE: Less than 1/3 second full scale with extremely high acceleration. Add critical damping and the recorder has unbeaten recording fidelity.

ACCURACY: Conservatively rated at ±0.2% overall inaccuracy, the typical recorder has linearity, calibrated errors and dead zones less than the trace width.

NOISE REJECTION: Unexcelled for common and normal mode rejection. Acute care in the layout and individual testing, combines with the differential nature to increase rejection by orders over conventional units.

ENVIRONMENTAL: Completely unaffected by wide variations in temperature, humidity, line voltage, or frequency.

MODULAR CONSTRUCTION: Amplifier, drive assemblies, and of course modules, are individually removable. They may be swapped with the complementary lines of X–Y, Strip Chart, and TY® Recorders.

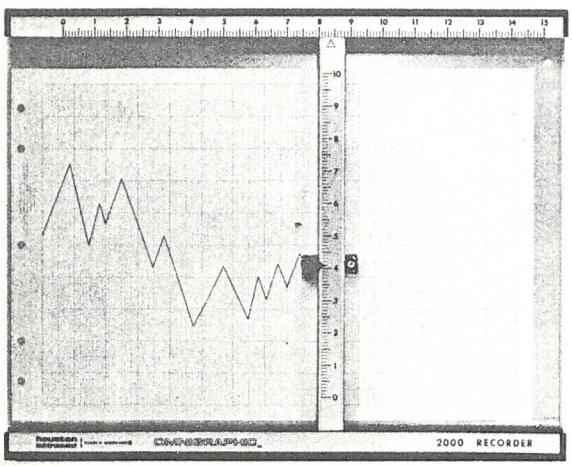
PAPER SIZE: Recorder will handle both 8-1/2 x 11 and 11 x 17 inch paper sizes, along with European types A4 and A3. With the inch/centimeter flexibility, the recorder is universal the world over – independent of discipline or national origin.

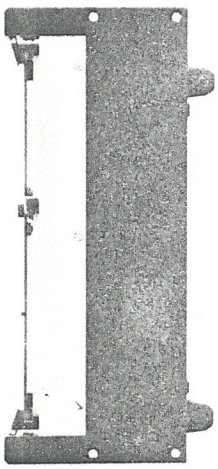
VACUUM HOLDDOWN: Silent retention of the paper. Unaffected by dust, temperature, humidity, line frequency or voltage. Contaminants pass thru the impeller turbine system which grips from mass air flow rather than ΔP. Maintenance free with no shock hazard.

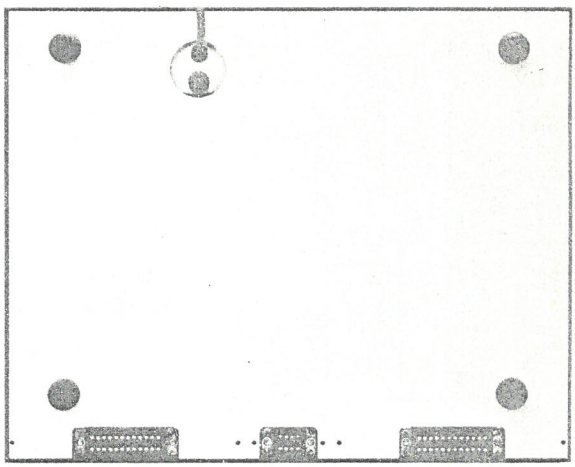
INTERCHANGEABLE AMPLIFIERS: Each axis has a completely independent servo mounted on its own plug-in circuit board. They may be swapped or even used in the complementary line of strip and T–Y® Recorders.

X–Y CONFORMITY: Acceleration, slewing speed, phasing and damping of X and Y axis drives in 2000 series recorders are matched for minimum error under dynamic conditions. Essential in analyzer, calculator, computer readout applications.

THE MAINFRAME







From any angle:

- Mechanical
- Electrical
- Price
- Flexibility

→ UNBEATABLE

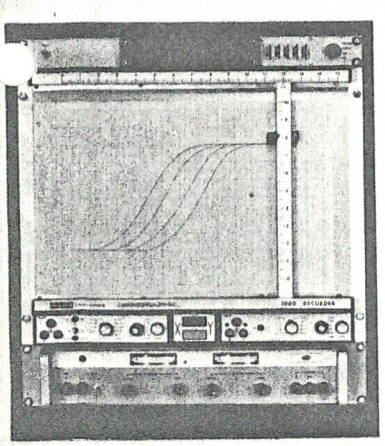
The mainframe is a complete working recorder without front panel controls. All inputs are via individual rear input connectors. Power and pen control, using contact closures, are via a separate rear connector. Input resistance is potentiometric with no less than 2 megohm slewing resistance. Zero is fixed or can be remotely controlled by running three shielded wires to an external 5K pot.

Power may be either 115 or 230 volt A. C. and is field convertible from one to the other. Case is mar resistant and unbreakable plastic, with a textured black finish. Bottom, sides and top are separately removable, involving only a total of eight screws. Total exposure is a minute's work. Sub–assemblies are all modular and field replaceable as units. Amplifiers are separate and interchangeable.

Standard accessories include five pens each of red and blue, instruction manual, plastic dust cover, spare fuse and cable, and Bristol wrenches. All are shipped in a specially molded styrofoam case.

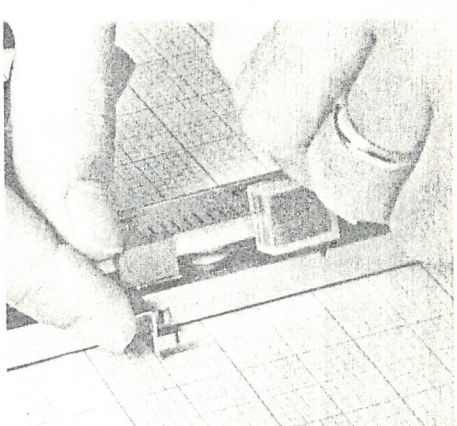
As a stand–alone unit, the mainframe is ideal for dedicated applications, where operational controls are better suited with the primary measurement or instrument controls, and most certainly as an OEM recorder. It offers the advantages of later expansion by addition of modules – without modification, and at any time.

And most certainly, the mainframe acts as the basic building block for general purpose recording by adding input and control modules. The same remote connectors mate directly into the plug–in modules, giving front panel control with wide variety.

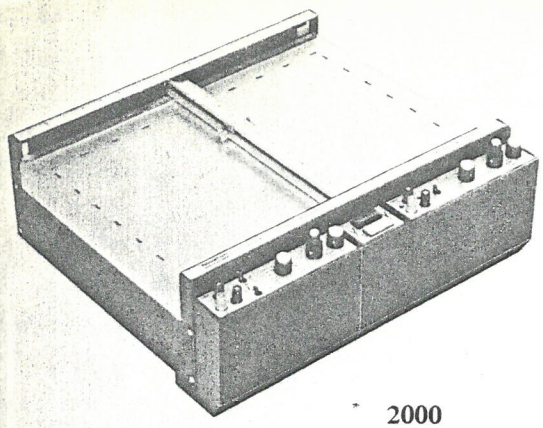


Rack

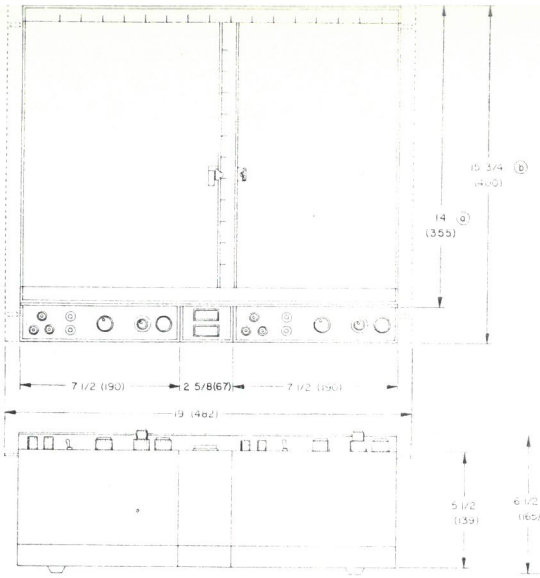
Bench

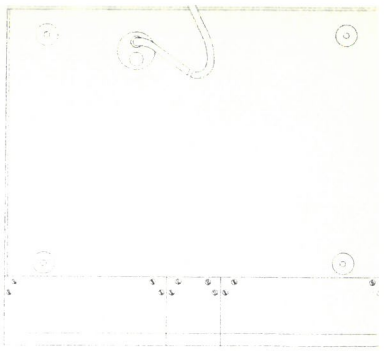


Pens Are Disposable and Snap on

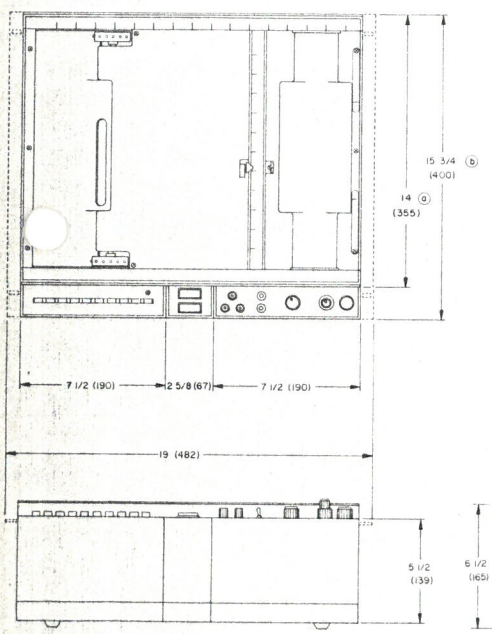


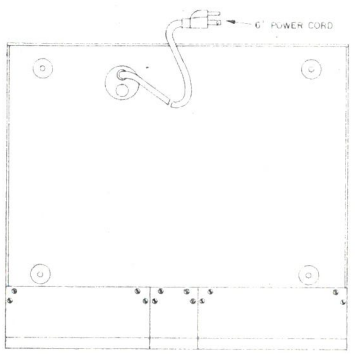
2000



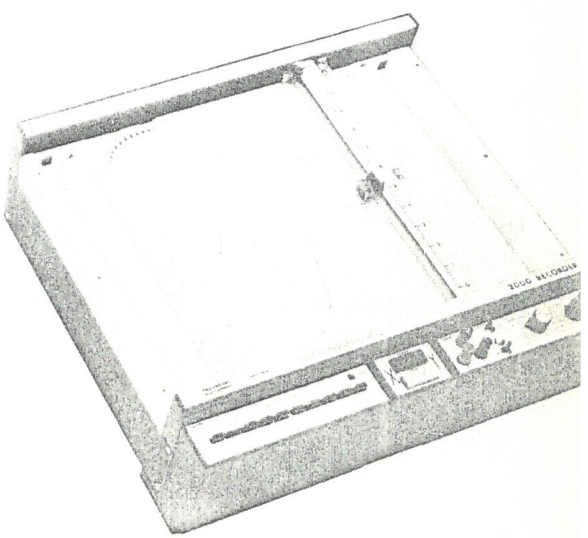


ALL DIMENSIONS IN INCHES AND (MILLIMETERS)

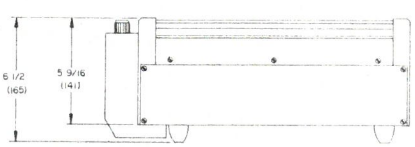




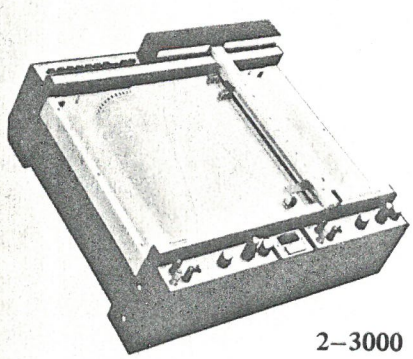
ALL DIMENSIONS IN INCHES AND (MILLIMETERS)



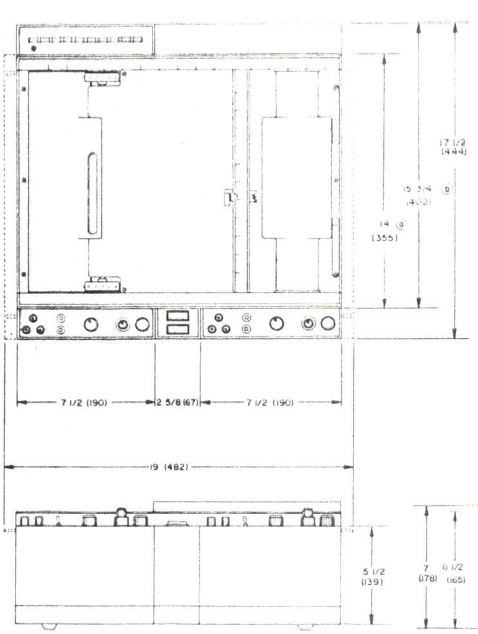
3000

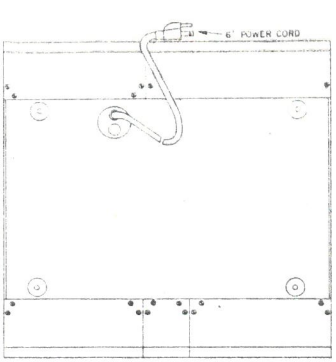


NOTE:
a WITHOUT MODULE
b WITH MODULE

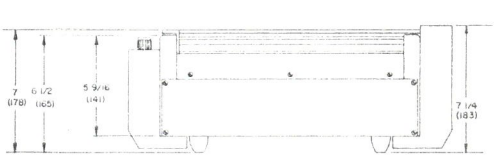


2–3000





ALL DIMENSIONS IN INCHES AND (MILLIMETERS)



MAINFRAME SPECIFICATIONS

X and Y AXES – 2000 X–Y RECORDER
Y AXIS – 3000 STRIP CHART RECORDER
Y1 and Y2 AXES – 2–3000 STRIP CHART RECORDER

RECORDING MECHANISM: Potentiometric servo with sealed rebalance potentiometer. Long life, snap-in, disposable pen.

RESPONSE TIME: 1/3 second full scale maximum independent of line voltage or frequency. Optional – 1/4 second.

ACCELERATION: > 1500 in/sec^2 (3750 cm/sec^2) on 1/3 second instrument; > 1800 in/sec^2 (4500 cm/sec^2) on 1/4 second instrument.

OVERSHOOT: Critical damping. Less than 1% overshoot on full scale steps; overshoot is not discernible on half scale or less steps.

ACCURACY: ±0.2% of full scale.

LINEARITY: ±0.1% of full scale.

REPEATABILITY: ±0.1% of full scale.

RESETABILITY: ±0.05% of full scale.

INPUT CHARACTERISTICS: Differential and floating to ±500 VDC or peak AC above ground.

INPUT RESISTANCE: Potentiometric; modulator input is shunted by 0.1 microfarad capacitor.

SENSITIVITY: Basic sensitivity of 1 mv/inch (0.5 mv/cm) is set by external gain control resistors.

STANDARDIZATION: Continuous double regulated zener with temperature compensation (±0.0025%/°C).

COMMON MODE REJECTION: On most sensitive range; 140 db at DC; 140 db at line frequency with up to 1K source resistance. Decreases 20 db per decade of attenuation for both AC and DC.

CHART AXIS
3000 and 2–3000 STRIP CHART RECORDER

CHARTS: 100 foot chart rolls, 12 inches wide with 10 inches or 250 mm writing width.

CHART FEED: Roll take up or positive paper feed, depending on operator choice.

CHART DRIVE MECHANISM: Stepper motor, unidirectional drive.

CHART SPEED: Proportional to chart drive pulse rate to 40 inches/minute at 360 pulses/inch chart motion, (300 pulses/inch in 50 Hz recorder).

DRIVE PULSE REQUIREMENTS: +5 to +50 volts into 10K ohms, D.C. coupled. Maximum pulse rate is 200 per second. Pulse rise, on, and off times are not critical, but the pulses should be at least 10 microseconds wide.

EVENT MARKER: Single event marker is actuated by closure of a pair of contacts. Contacts make and break 12 volt, 0.5 amp inductive circuit.

GENERAL SPECIFICATIONS

PEN UP/DOWN: Closure of a pair of contacts lowers recording pen; opening the contacts raises pen. Contacts make and break 12 volt, 0.5 amp inductive circuit.

MOUNTING: Bench, rack, or panel. May be mounted at any angle to 90° any axis.

WEIGHT: With modules, 30 lbs. (13.5 Kg); shipping 34 lbs. (15.3 Kg). Mainframe only 26 lbs. (11.7 Kg).

ENVIRONMENTAL: 0 to 40°C operating. –10 to 60°C storage; 0–95% relative humidity at 30°C dry bulb.

POWER: 2000 X–Y Recorder – 115/230 VAC; 50–60 Hz; 60 volt amperes.
3000 and 2–3000 Strip Chart Recorders – 115/230 VAC; 50 or 60 Hz; 50 volt amperes. If Type 50 or 52 Time Base module is to be used and line frequency is 50 Hz, the recorder must be ordered for 50 Hz. operation.

TERMINAL BOXES: For O.E.M. and dedicated use. Where the various functional modules are not used the recorder is shipped with terminal boxes. These are installed in the module connectors on the underside of the recorder. Signal and control input circuits in the recorder are accessed via barrier strips installed in the terminal boxes. Consult Houston Instrument or its representative for additional details concerning O.E.M. applications.

Model 2000 X–Y Recorder . . . . . .
Model 3000 Strip Chart Recorder . . . . . .
Model 2–3000 Two Pen Strip Chart Recorder . . .
Rack Mounting Wings . . . . . .

OPTIONS:

40 inch/second Servo
- 2000 (Both axes only) . . . . . .
- 3000 . . . . . .
- 2–3000 (Both axes only) . . . . . .

Retransmit Potentiometer
- 2000 Per axis . . . . . .
- 3000 Y axis only . . . . . .
- 2–3000 Y1 axis only . . . . . .

High–Low Limit Switches –Per axis . . . . . .
115/230 VAC, 50 Hz. mains operation . . . .

MODULES

Plug-in modules vastly expand the uses of the recorder mainframe. Modules provide front panel signal, power and pen controls for general purpose recording. In general, each is self contained and plugs directly into the recorder.

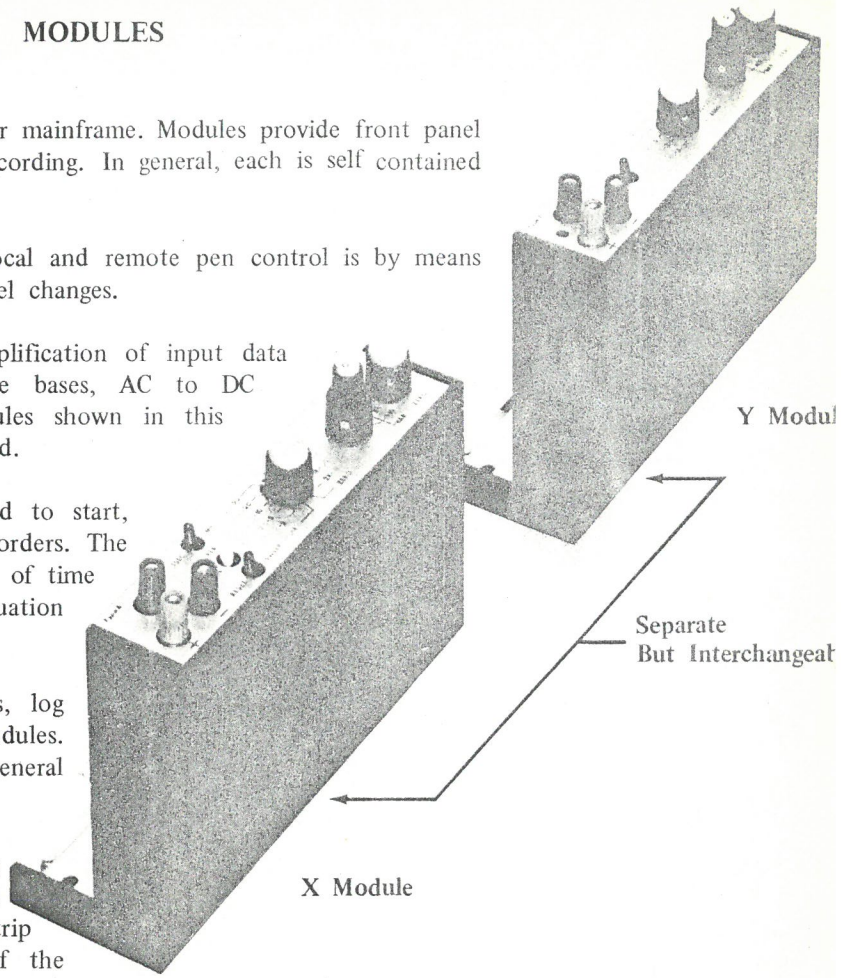
Control modules control line power, pen up/down. Local and remote pen control is by means of switch contact operation or, optionally, by logic level changes.

Signal module functions include attenuation and amplification of input data signals, generation of linear voltage ramps for time bases, AC to DC conversion. In addition to the standard signal modules shown in this brochure dozens of special modules have been developed.

Time base and chart drive control modules are used to start, stop, and control the chart speed of strip chart recorders. The event marker pushbutton is located on the front panel of time base modules. Remote start/stop and event marker actuation is accomplished by operation of switch contacts.

Point plotters, integrators, thermocouple compensators, log voltage amplifiers are examples of special function modules. In general these modules are interchangeable with general purpose plug-ins.

Most signal modules have universal five way binding post or BNC connectors on the front panel. All control, signal, and time base modules have barrier strip access to control and signal inputs at the rear of the modules. Signal and control cabling may be concealed by routing to the barrier strip along the underside of the recorder.

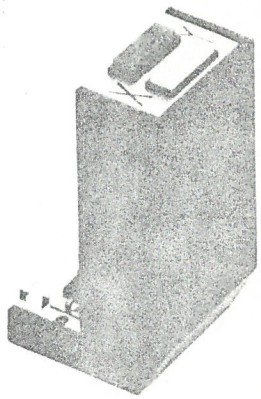


A BRIEF GUIDE TO MODULES

TYPE	DESCRIPTION	PURPOSE	USE WITH		
			2000	3000	2–3000
0	Customizing	"Do it yourself" – Signal Axis	*	*	*
00	Customizing	"Do it yourself" – Time Axis		*	*
1	DC Coupler	Dedicated; OEM	*	*	*
2	Ranging	Economy Variable Range	*	*	*
3	Switching	Economy Switched Attenuator	*	*	*
4	Switching/Time Base	Economy Switched Attenuator and Time Base	*		
5	Precision Attenuator	14 Calibrated Ranges	*	*	*
6	Precision Attenuator/Time Base	14 Calibrated Ranges and Sweeps	*		
7	Preamp/Attenuator	17 Ranges from 100 mv/inch	*	*	*
8	Preamp/Attenuator/Time Base	17 Ranges from 100 mv/inch and 18 Sweeps	*		
9	Precision Ranging	For Wide Range Precision	*	*	*
10	High Sensitivity AC	100 mv to 50 v/inch; AC only	*	*	*
11	Preamp; Fixed Span	100 mv/inch DC	*	*	*
12	Precision Attenuator/Offset	Up to 100:1 Offset	*	*	*
13	Integrator	Record Amplitude – Time Integral			*
14	Log Converter	1–2–3 Decade Log Amplifier	*	*	*
15	Two Channel Switching	Multiplex Two DC Signals	*	*	*
16/17	Point Plotter	Analyzer/Computer Readout		*	
18	Thermocouple Reference	Terminate JKS Thermocouples	*	*	*
20	AC/DC Switching	General Purpose AC and DC	*	*	*
26/17	Point Plotter	Analyzer/Computer Readout	*		

CONTROL MODULES

Lighted pushbuttons control AC power and pen up/down. Rear terminals allow remote control by switch contact operation. Required when signal or time base modules are used.



TYPE	DESCRIPTION	USE WITH		
		2000	3000	2–3000
100	Power On/Off: Logic Level Remote Pen Control	*	*	
200	Power On/Off: Switch Contact Remote Pen Control	*	*	
300	Same As Type 200; Legend for 2 Pen Recorder			*
400	Same As Type 100; Legend for 2 Pen Recorder			*

SWEEP MODULES

Pushbutton selection of nine chart speeds and actuation of event marker. Chart speed is referenced to line frequency, to internal stable oscillator, or external pulse train.

CHART SPEEDS: In standard 3000 main frame:

Inches: .05, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20 inches/minute.
Centimeters: 0.1, 0.2, 0.4, 1, 2, 4, 10, 20, 40 cm/minute.

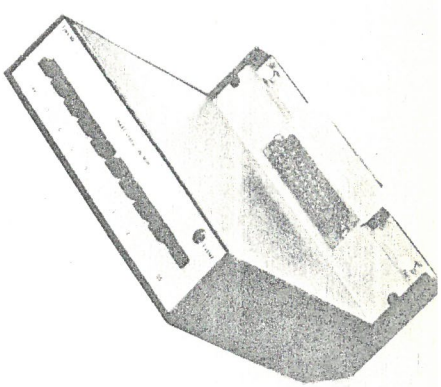
CHART SPEED ACCURACY:

Line frequency reference: Dependent on accuracy of line frequency.
Internal frequency reference: 0.1% of selected speed.

EXTERNAL PULSE INPUT:

0 to +5 volts or greater into 10K ohms. D.C. coupled, >10μ seconds duration, 200/second maximum.

SELECTION CHART

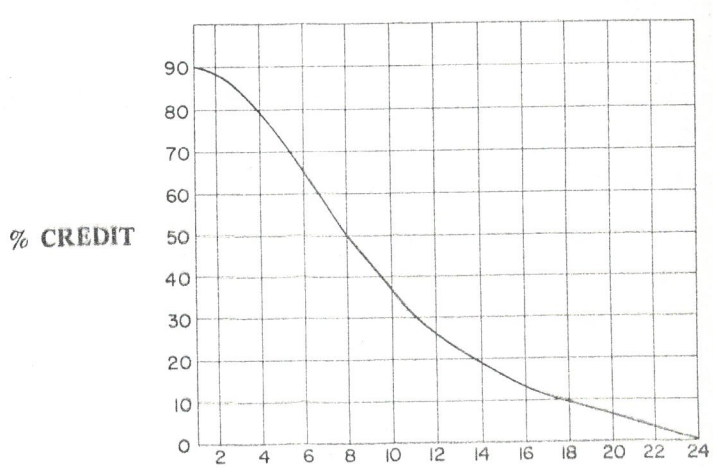


TYPE	CHART SPEED UNITS		REFERENCE FREQUENCY		USE WITH	
	IN/MIN	CM/MIN	LINE	INTERNAL	3000	2–3000
50	*		*		*	
52	*		*			*
54	*	*		*	*	
55	*	*		*		*

TRADE–IN POLICY: Inevitably, a new need is found for the recorder. And very possibly a different module best suits the new application. In study of the modules, one notes that each offers somewhat more than the predecessor. Effectively, a new module could obsolete the old unit. Houston abhors the shelves full of dust gathering modules created by some instruments. Only the most flexible units are desired - the others sit. Our wide selection of modules could create an identical situation.

A simple trade-in policy banishes this ill. Credit against a new module purchase is allowed on the old unit. Credit is proportionate to age – not use, other than normal wear and tear.

So purchase originally only that needed. Then later upgrade at a minimal premium. And never put one aside – trade it in.



MODULE TRADE–IN CREDIT

OMNIGRAPHIC® 3000 STRIP CHART RECORDERS

ADVANTAGES OVER CONVENTIONAL RECORDERS

LEFT TO RIGHT TRACE. Most units feed the paper top to bottom as a convenience to the manufacturer. Graphs are read by either head bending or artificially training the eye. The 3000 Strips read naturally, whether in a rack, on the bench, flat, or standing on end.

STATE OF THE ART CHART DRIVE. Speed changes are reflected in instantaneous chart movement. Other recorders using gear shifters or transmissions have objectionable time lapses while backlash is overcome.

PLUG–IN MODULES. Most conventional strips are application limited by fixed ranges. Some do have very wide ranges and commensurate prices. The 3000 can be either and can be changed at any time with the inexpensive modules.

CHART LOADING. Simple and direct, there are no magazines to remove – no threading around, in, and behind bars.

SNAP IN PENS, ELECTRIC PEN LIFT, AND EVENT MARKER are standard. Most strips use complicated capillary pen systems and only offer electric lifts and event markers as options.

FEATURES

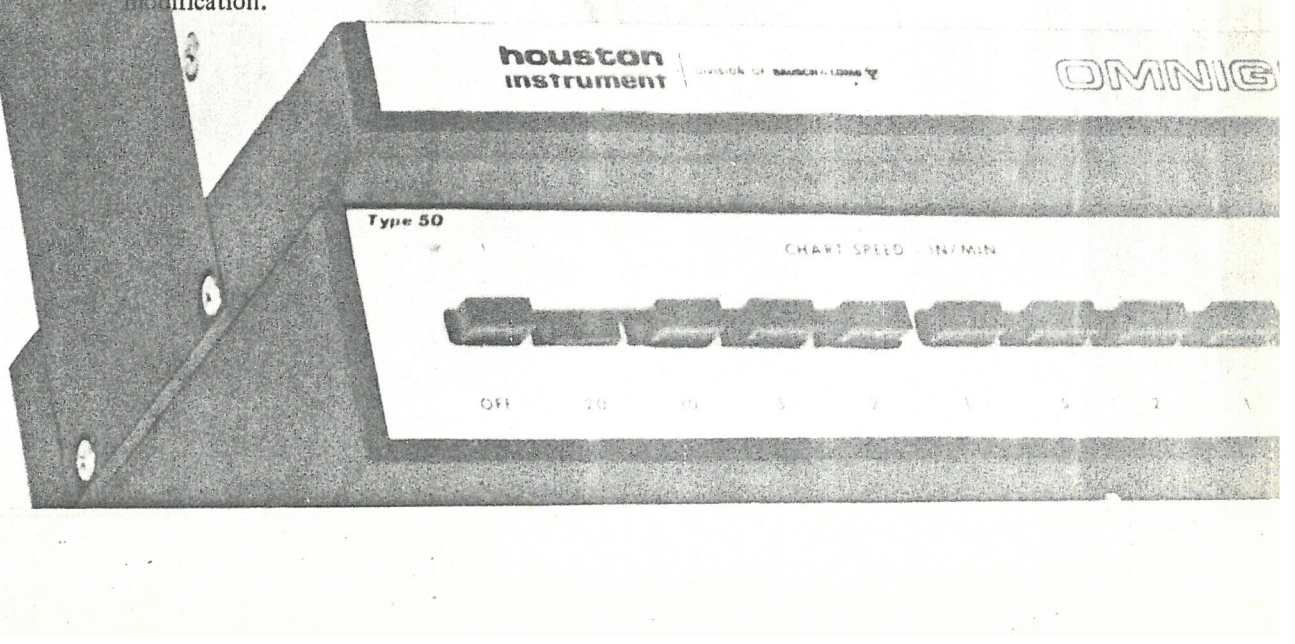
CHART: 10 inch (or 25 cm) wide chart grid, 100 foot roll.

NUMBER OF PENS: One and two pen recorders plus event marker are available. Second pen in two pen recorder is offset 0.3 inches so both pens can traverse full 10 inch chart width. Y axis (both in 2–3000) and event pens are raised and lowered together.

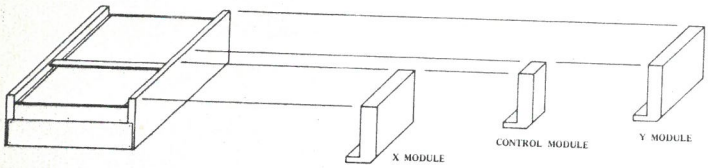
EVENT MARKER: A single event marker is a standard feature of both one and two pen recorders. The event marker is actuated by pushbutton on time base module or external contact closure.

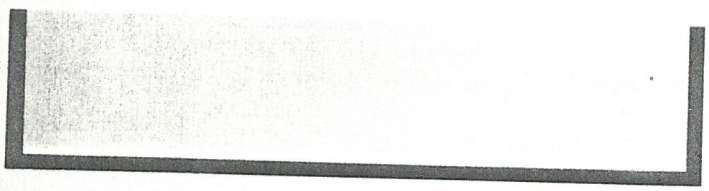
DIGITAL CHART SPEED: Nine pushbutton selected speeds. Instantaneous reaction as there are no gear transmissions, clutches or kinematic wonders.

PAPER FEED: Roll takeup or positive paper feed without modification.

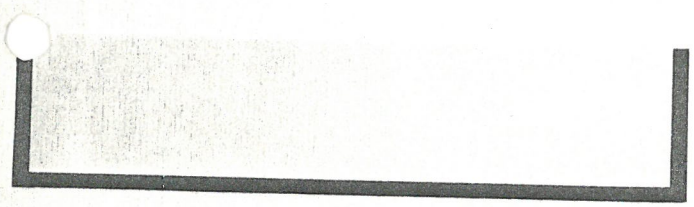


SIGNAL MODULES

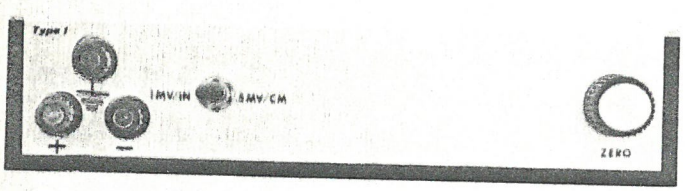




TYPE 0 – CUSTOMIZING: This module is ideal for specials. Comes complete with chassis, housing, blank front panel decal, mainframe connector and remote barrier strip. Precision resistors for amplifier scaling and IN – CM scaling are installed. For X and Y inputs to 2000 and Y input to 3000 (both Y channels in 2–3000).



TYPE 00 – CUSTOMIZING: Blank module for chart axis drive in 3000 and 2–3000 recorders. Includes chassis, housing, mainframe connector, and remote barrier strip.



T 1 – DC COUPLER: A fixed sensitivity signal is fed via the input terminals directly into the recorder mainframe.

Front panel IN/CM scaling choice and zero control give operational flexibility. This module is predominantly for dedicated applications.

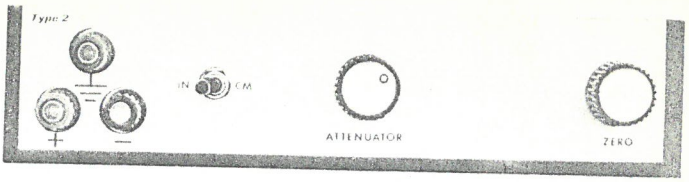
Sensitivity: One fixed DC Range of 1 mv/inch (0.5 mv/cm).

Scaling: IN/CM sw. for choice of sensitivity and paper grid.

Input Resistance: 1 megohm all conditions.

Zero: ±110% of full scale with ten turn control; friction drag prevents inadvertent movement.

Input: Universal 5 way front panel terminal; parallel remote terminal on module bottom.



TYPE 2 – DC RANGING: An inexpensive module for continuous, but non–calibrated, span adjustments.

Senisitivity: 1 mv/inch (0.5 mv/cm) continuously variable with non-calibrated ten turn control.

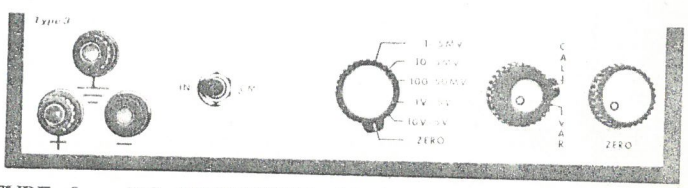
Scaling: IN/CM sw. for choice of sensitivity and paper grid.

Input Resistance: 100 K ohms. Fixed all conditions.

Zero: ±110% of full scale with ten turn control; friction drag prevents inadvertent movement.

Inputs: Universal 5 way front panel terminals; parallel remote terminals on module bottom.

Option: Type 2A includes 10 turn dial calibrated attenuator control.



TYPE 3 – DC SWITCHING: Moderately priced, this flexible module is ideal for everyday use. Each of its five ranges is calibrated, accurate and ultra–stable.

Sensitivity: 5 ranges of 1, 10, 100 mv/inch; 1, 10 volt/inch AND 5 Metric ranges of 0.5, 5, 50 mv/cm; 0.5, 5 volt/cm. All ranges fixed, switch selectable and calibrated; between range variable control.

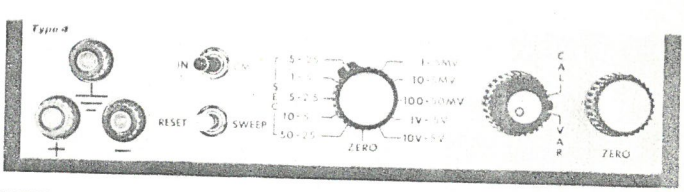
Scaling: IN/CM sw. for choice of sensitivity and paper grid.

Input Resistance: 1 megohm. Fixed all conditions.

Zero: ±110% of full scale with ten turn control; friction drag prevents inadvertent movement.

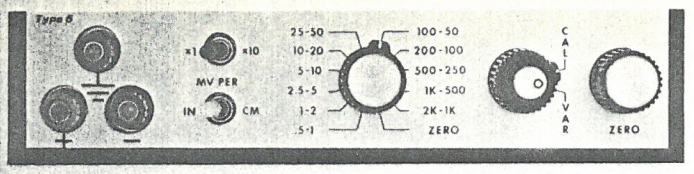
Zero Check: Verifies position and allows calibration of zero without disconnecting or shorting input signal.

Inputs: Universal 5 way front panel terminals; parallel remote terminals on module bottom.



TYPE 4 – DC SWITCHING/TIME BASE: A perfect companion for the Type 3 Module. By flick of a switch the variable (X or Y) can be voltage attenuated or the axis driven according to time. Use on X or Y axis.

Time Base Ranges: 5 sweeps of 0.5, 1, 5, 10, 50 sec/inch AND 5 Metric sweeps of 0.25, 0.5, 2.5, 5, 25 sec/cm. All ranges fixed, switch selectable and calibrated; between range variable control.



TYPE 5 – DC PRECISION ATTENUATOR: Fourteen calibrated ranges in a 1–2–5 switching sequence. Variable control gives between range span adjustments.

Sensitivity: 14 ranges of 1, 2, 5, 10, 20, 50, 100, 200 mv/inch; 0.5, 1, 2, 5, 10, 20 v/inch AND 14 Metric ranges of 0.5, 1, 2.5, 5, 10, 25, 50, 100, 250 mv/cm; 0.5, 1, 2.5, 5, 10 volt/cm. All ranges fixed, switch selectable, and calibrated; between range variable control.

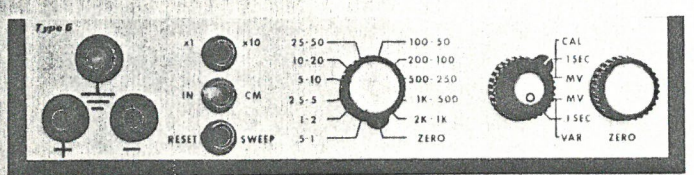
Scaling: IN/CM sw. for choice of sensitivity and paper grid.

Input Resistance: 1 megohm. Fixed all conditions.

Zero: ±110% of full scale with ten turn control; friction drag prevents inadvertent movement.

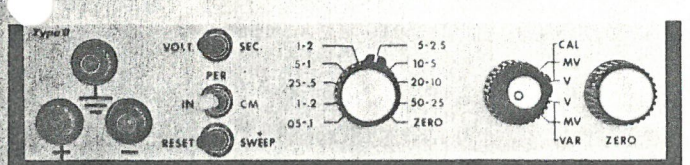
Zero Check: Verifies position and allows calibration of zero without disconnecting or shorting input signal.

Inputs: Universal 5 way front panel terminals; parallel remote terminals on module bottom.



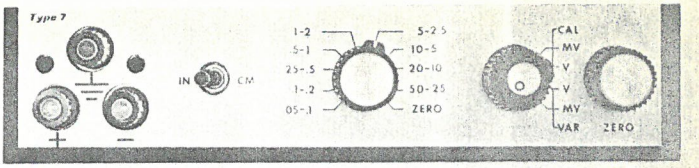
TYPE 6 – DC PRECISION ATTENUATOR/TIME BASE: All features of the Type 5 Module plus voltage ranging or time base operation at the flip of a switch.

Time Base Ranges: 11 sweeps of 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50, 100, 200 sec/inch AND 11 Metric sweeps of 0.05, 0.1, 0.25, 0.5, 1, 2.5, 5, 10, 25, 50 and 100 sec/cm. All ranges fixed, switch selectable, and calibrated; between range variable control.



TYPE 8 – DC PRE–AMPLIFIER/TIME BASE: A combination of the high sensitivity Type 7 with a wide selection of time sweeps. It can be used for X or Y axes.

Time Base Ranges: 9 sweeps from 0.1 to 50 seconds per inch in 1–2–5 steps and 9 sweeps from 0.05 to 25 seconds per centimeter. All ranges fixed, switch selectable, and calibrated; between range variable control.



TYPE 7 – DC PRE–AMPLIFIER: Eighteen ranges from 100 μvolts per inch to 20 v/inch (and their Metric equivalents) give outstanding recording capabilities.

Sensitivity: 17 ranges from 0.1 millivolts to 20 volts per inch in 1–2–5– steps and 17 ranges from 0.05 millivolts to 10 volts per centimeter. All ranges fixes, switch selectable and calibrated; between range variable control.

Scaling: IN/CM sw. for choice of sensitivity and paper grid.

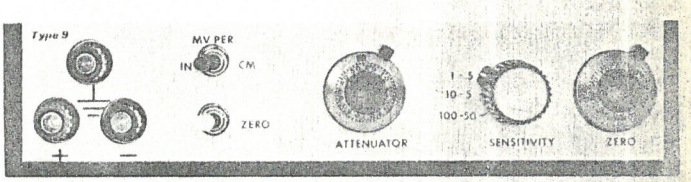
Input Resistance: Potentiometric all millivolt ranges. On volt ranges – 1 megohm. Fixed all conditions.

Zero: ±110% of full scale with ten turn control; friction drag prevents inadvertent movement.

Zero Check: Verifies position and allows calibration of zero without disconnecting or shorting input signal.

Zero Drift: 1 microvolt/^{O}C after 5 minute warmup.

Inputs: Universal 5 way front panel terminals; parallel remote terminals on module bottom.



TYPE 9 – PRECISION RANGING: Continuous calibrated scaling by means of a ten turn dial indicating attenuator. Zero control also features dial indication.

Sensitivity: 3 ranges of 1, 10, 100 mv/inch AND 3 Metric ranges of 0.5, 5, 50 mv/cm; each is fixed, calibrated, and switch selectable. Ten turn dial indicating range vernier allows precise and calibrated mid range setting.

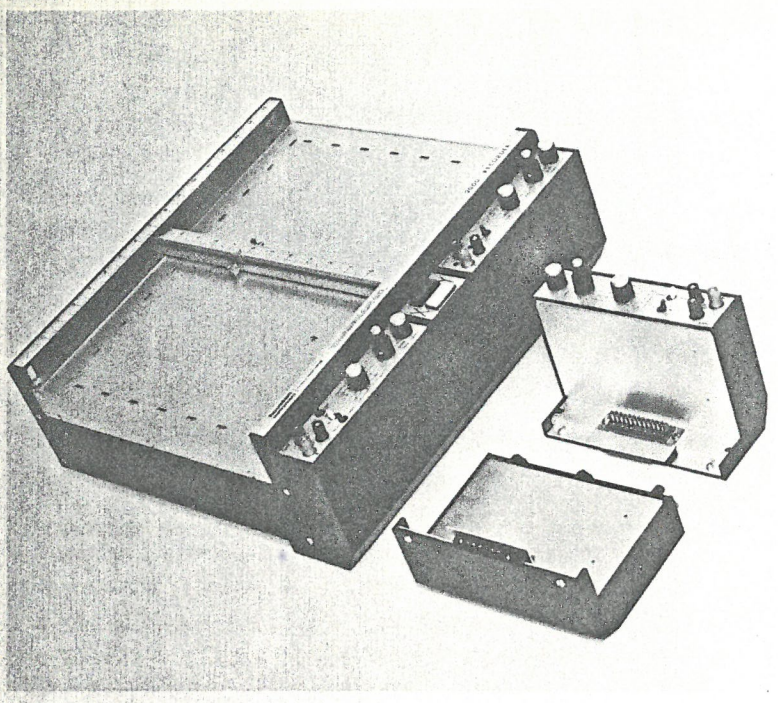
Scaling: IN/CM sw. for choice of sensitivity and paper grid.

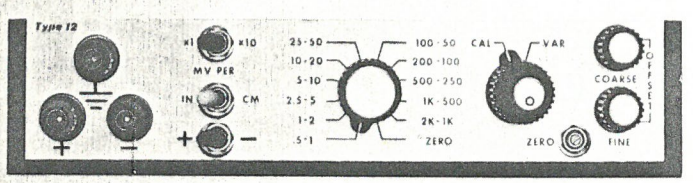
Input Resistance: 100 K ohm on 1 mv/inch. 1 megohm all other ranges. Fixed all conditions.

Zero: Ten turn zero has dial indication for precise setting.

Zero Check: Verifies position and allows calibration of zero without disconnecting or shorting input signal.

Inputs: Universal 5 way front panel terminals; parallel remote terminals on module bottom.





TYPE 12 – PRECISION ATTENUATOR/OFFSET: Type 12 has 0–1 volt adjustable offset, also giving the fourteen multipurpose ranges of the Type 5 Module. Two controls give precise dial–in voltages of 0–1 volt (coarse) and 0 to 10 mv (fine). The conventional zero control is retained to preserve the identity of offset and zeroing.

Sensitivity: 14 ranges of 1, 2, 5, 10, 20, 50, 100, 200 mv/inch; 0.5, 1, 2, 5, 10, 20 v/inch AND 14 Metric ranges of 0.5, 1, 2.5, 5, 10, 25, 50, 100. 250 mv/cm; 0.5, 1, 2.5, 5, 10 volt/cm. All ranges fixed, switch selectable, and calibrated; between range variable control.

Scaling: IN/CM sw. for choice of sensitivity and paper grid.

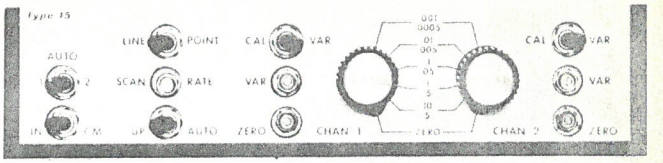
Input Resistance: 1 megohm. Fixed all conditions.

Zero Offset: Coarse (0–1 volt) and fine (0–10 mv) ten turn controls with polarity switch.

Zero Check: Verifies position and allows calibration of zero offset without disconnecting or shorting input signal.

Offset Polarity Sw.: Determines offset polarity. Has center position for Zero Offset.

Inputs: Universal 5 way front panel terminals; parallel remote terminals on module bottom.



TYPE 15 – TWO CHANNEL DC SWITCHING: An economical way to record two data signals in a single recording channel. Attenuators and zero controls are independent, the inputs may even be of opposite polarities. Basic specifications for each channel same as Type 3 except as noted.

Input Resistance: One megohm on calibrated ranges; greater than 500K ohms uncalibrated.

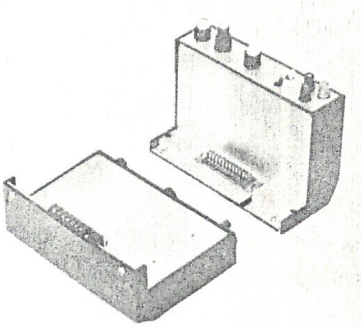
Conformity: The sensitivities of the two channels differ by less than 0.1% at each of the five calibrated attenuator settings.

Input: Signal high, low, and ground are connected to a barrier strip at the rear of the module.

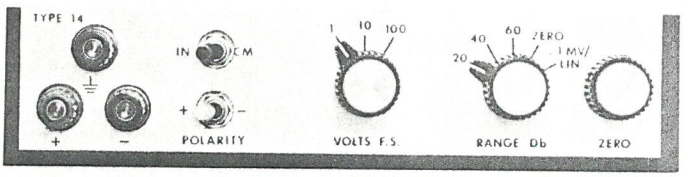
Channel Selection: Channel 1, channel 2, or both channels alternately.

Pen Control: Point: Pen is momentarily lowered at selected rate, resulting in a succession of points.
Line: Pen is alternately raised and lowered at selected rate, resulting in a succession of discontinuous line segments.
Duty Cycle: Dwell (marking) time of channel 1 can be set to 1X, 2X, or 3X that of channel 2.

Sampling Rate: Adjustable from 3 to 40 pairs of points in multiplex mode, 6 to 80 points in single channel mode per minute.



ON THIS PAGE
SPECIAL PURPOSE MODULES



TYPE 14 – DC LOG CONVERTER: For DC recording where resolution and dynamic range are of equal concern.

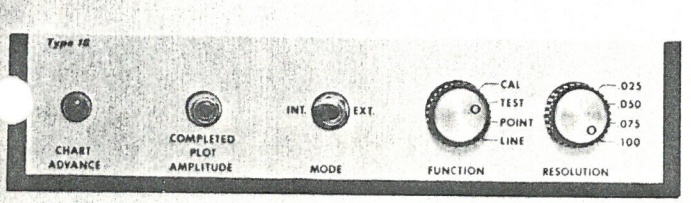
Full Scale Voltage: 1, 10, 100 volts.

Dynamic Range: 20, 40, 60 db (1, 2, 3 decades).

Conversion Accuracy: ±0.2% of range (in db).

Input Resistance: One megohm.

Input: Universal 5 way front panel terminals; parallel remote terminals on module bottom.



TYPE 16/17 – POINT PLOTTER: Chart and pen axis modules used with OMNIGRAPHIC® 3000 strip chart recorder for point plot readout of digital to analog converters in multi–channel pulse height analyzers, digital computers, and similar source of successive discrete data points.

Chart Axis:

Resolution: .025, .050, .075, .100 inches chart advance per plot.

Plot Advance Rate: 12 points/second max.

Pen Axis:

Sensitivity: 1, 10, 100 millivolts 1 and 10 volts per inch; 0.5, 5, 50 millivolts, 0.5 and 5 volts per centimeter; continuously variable vernier between ranges.

Input Resistance: One megohm constant, all conditions.

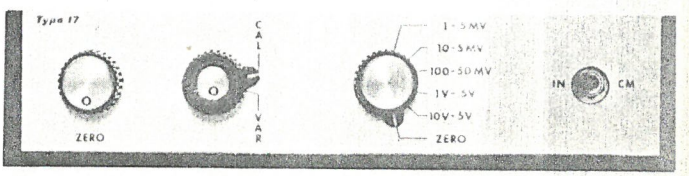
Zero: ±110% of full scale referred to chart zero.

Interface:

Seek Command: +3 to +12 volts or −3 to −12 volts; 0.3 μsec/volt rise time, maximum; 2 μsec. duration, minimum.

Completed Plot Command: Variable from zero to +18 or −18 volts; 0.2 μsec/volt rise time minimum; 15 milliseconds duration.

Disable Command: +3 to +12 or −3 to −12 volts.



TYPE 26/17 – POINT PLOTTER: Chart (X) and pen (Y) axis point plotter modules for OMNIGRAPHIC® 2000. In addition to scaling X and Y input signals, these modules include Y axis null detector and logic to accept and generate synchronizing and pen up/down controls. Cables are available for connecting the Point Plotter to most multi–channel pulse height analyzers.

Data Inputs:

Sensitivity: X and Y axes: 1, 10, 100 millivolts, 1 and 10 volts/inch; 0.5, 5, 50 millivolts, 0.5 and 5 volt/centimeter. Continuously variable vernier between adjacent ranges.

Input Resistance: One megohm constant, all conditions.

Zero: ±110% of full scale referred to chart zero.

Interface:

Seek Command: +3 to +12 volts or −3 to −12 volts; 0.3 μsec/volt rise time, maximum; 2 μsec. duration, minimum.

Completed Plot Command: Variable from zero to +18 or −18 volts; 0.2 μsec/volt rise time minimum; 15 milliseconds duration.

Disable Command: +3 to +12 or −3 to −12 volts.

Plotting Characteristics:

Plot Modes: Calibrate, Point, Line, X–Y, Standby.

Plot Rate: 600 points per minute average, 720 points per minute maximum.

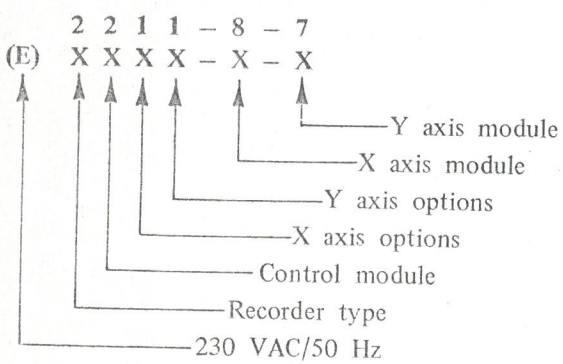
O.E.M. RECORDERS

Variations of the basic OMNIGRAPHIC® 2000 X–Y and 3000 Strip Chart recorders can result in substantial savings in cost and complexity for O.E.M. and other quantity purchasers. Consult Houston Instrument or its representative for detailed information concerning any of the following recorders.

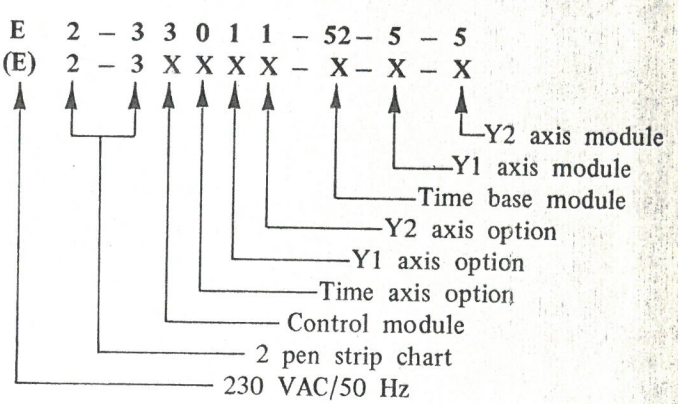
OMNIGRAPHIC® 4000: The X axis servo system of the 2000 X–Y recorder is replaced by a stepper motor drive in the 4000 T–Y® recorder. The Y axis characteristics and other features of the 2000 X–Y recorder are unaffected. This recorder combines the time base of the strip chart recorder and the compact format of the X–Y chart.

MODEL IDENTIFICATION

2000 X–Y
3000 STRIP CHART



2–3000 TWO PEN STRIP CHART



RECORDER OPTIONS

DESIGNATOR	DESCRIPTION	
1	High speed servo: > 40 in/sec	2000 (both axes only) 3000 and 2–3000 (Y axis only)
2	Retransmitting Potentiometer	2000 3000 and 2–3000 (Y axis only)
3	High Speed Servo and Retransmitting Potentiometer	2000 (both axes only) 3000 and 2–3000 (Y axis only)
4	High–Low Limit Switches	2000 3000 and 2–3000 (Y axis only)
5	Special Increment Size	3000 and 2–3000 (X axis only)

IN ORDERING PLEASE SPECIFY

1. Recorder Model No., ie 2000 X–Y, 3000 Strip Chart
2. Control Module Type
3. X Axis Module Type
4. Y Axis (Y1 & Y2 in 2–3000) Modules
5. X Axis Options
6. Y (Y1 and Y2 in 2–3000) Options
7. 230 VAC/50 Hz Operation

RECORDING SUPPLIES

CHART PAPER

Popular papers are listed. Specify heavy or light weight when ordering.

CAT. NO.	DESCRIPTION
101512	11 x 16½ with 10 x 12 major divisions
101515	11 x 16½ with 1 inch square major grid
101538	11 x 16½ with 1 cm square major grid
34504	8½ x 11 with 1 inch square major division
81012	8½ x 11 with 10 x 12 major divisions
81015	8½ x 11 with 10 x 15 major divisions
RC–109	Y axis 10 major divisions in inches X axis 100 foot long, 1 inch major divisions
RC–110	Y axis 25 cm (1 cm/major division) X axis 100 foot long, 1 inch major divisions
RC–129	Y axis 25 cm; 2.5 cm/major divisions X axis 1 cm major, 0.2 cm minor divisions 30.5 meters long
RC–115	Blank Roll 12 inches x 100 foot long

PENS

CAT. NO.	DESCRIPTION
P–40	Packet 10 pens – red
P–41	Packet 10 pens – blue
P–42	Packet 10 pens – green
P–43	Packet 10 pens – black
P–52	Packet 10 pens – black & red

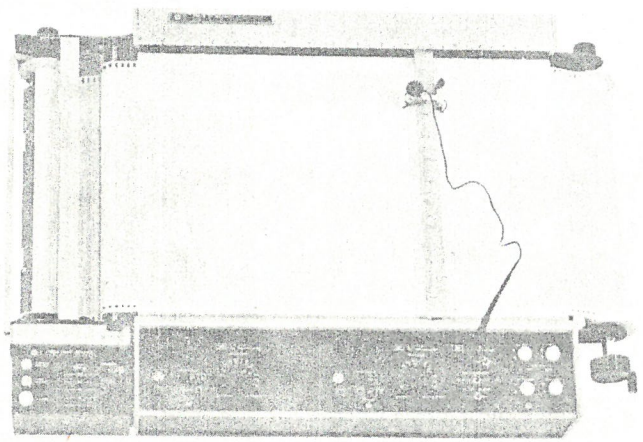
RECORDERS & PRINTERS

Incremental chart advance, point plotter

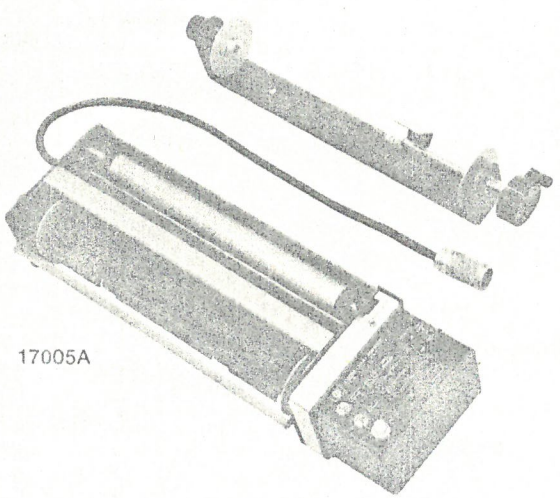
Models 7591A, 17005A & 17012B/C

Zet. 8

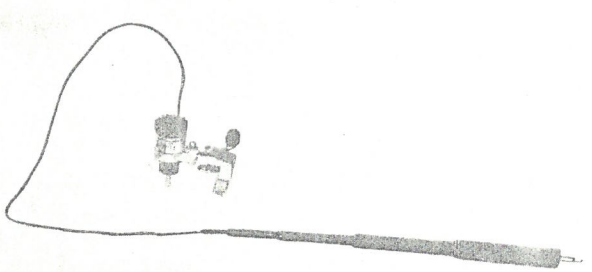
- Fast, economical
- Roll or fanfold paper



7591A



17005A



17012B/C

The 7591A Point Plotter System, which includes the 17005A Incremental Chart Advance, a 7004B X-Y Recorder, 17012B Point Plotter, the 17173 Null Detector, and other plug-ins like the dc offset, filter, or scanner which may be added to extend capabilities, is a fast and economical way to point plot analog data from computers, pulse height analyzers, signal averagers, and multi-channel analyzers. The system is capable of operating in a closed-loop mode up to 3000 plots/minute and control signals are provided to operate external logic or equipment. It will plot on any size of sheet paper up to 27.9 cm × 43.2 cm (11 × 17 in.), on a roll, or fanfold paper.

The 17005A chart advance, which may be selected individually for other applications, is available in several types of chart advance modes. The frame advance mode, which permits successive X-Y plots to be made during unattended operation, indexes to within 0.13 mm (0.005 in.) of the original chart location. The time base mode converts the recorder from X-Y to strip chart operation, while the incremental mode advances the chart in small increments in response to an external signal.

The 17012B is a high speed point plotter with maximum plot rates of 50 plots/second. The assembly mounts on the recorder pen carriage block in place of the pen and pen holder. This model is used on the 7591A System or an individual 7004B recorder. The 17012C is designed for use on the 7034A recorder. Actuating sources for both are obtained from the 17173A Null Detector which allows rapid plotting for applications such as high speed readout for a multi-channel pulse height analyzer, or the 17176A Scanner that permits plotting of two inputs on a single axis to form X-Y_1, Y_2 or X_2, X_2-Y recorder.

7591A Specifications

Plot rate: Up to 50 plot/s. Limited by amplitude excursion of recorder.

17005 Specifications

Frame advance mode:
- **Advance distance:** 60 cm (24 in.); time: less than 20 s.
- **Accuracy:** 0.0125 cm (±0.005 in.) non-cumulative.

Time base mode:
- **Speeds:** 0.4, 2, 4, 20, 40 s/cm (1, 5, 10, 50, 100 s/in.).
- **Accuracy:** ±2%.

Incremental advance mode:
- **Plot density:** 80, 40, 20, 8, 4 plots/cm (200, 100, 50, 20, 10 plots/in.).
- **Max advance rate:** 100, 90, 50, 20, 10 plots/s.
- **Accuracy:** 0.005 cm (±0.002 in.) non-cumulative.

Power: supplied by recorder.

Weight: net, 5 kg (11 lb); shipping, 7.3 kg (16 lb).

Model number and name

7591A (includes 7004B-004, 17173A, 17012B, and 17005A-004) — one additional plug-in is required for each axis
Option 001 — Metrically scaled and calibrated
Option 002 — X-axis retransmitting potentiometer, 5 kΩ, ±0.1% linearity
Option 003 — Fan fold adapter (used with 17005A)
Option 008 — 7591A without 17005A (Option 004) Incremental Chart Advance

17005A
Option 001 — Fan fold adapter
Option 002 — Metric scale
Option 004 — Compatibility with 7004B – Option 004

17012B (fits Model 7004B)
17012C (fits Model 7034A)

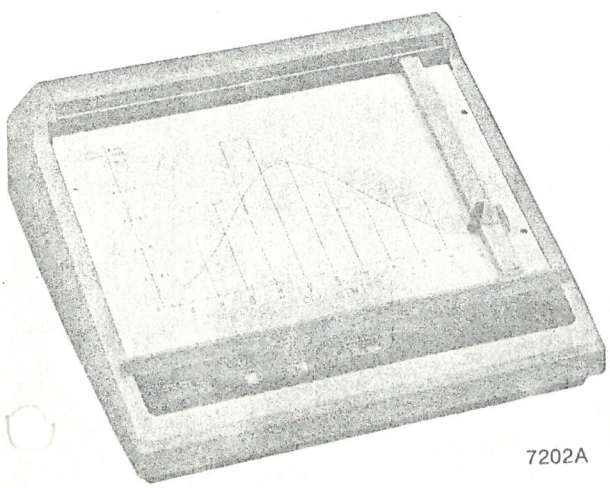
Zat. 9

RECORDERS & PRINTERS

Digital input graphic plotters

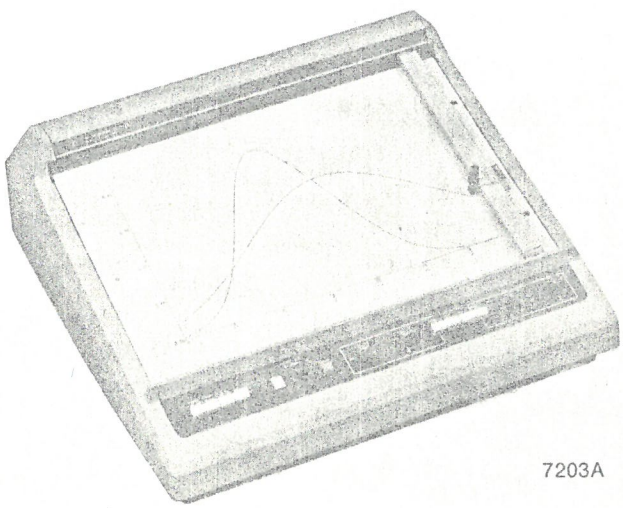
Models 7202A & 7203A

- Easy to own



7202A

- Easy to interface



7203A

A 7200 Series Graphic Plotter will add a new dimension to your communications terminal. Instead of a column of numbers, your data appears as easy-to-understand charts and graphs. Operation is simple and smooth. Use any size graph paper up to 27.9 × 43.2 cm (11 × 17 inches) with or without grids. Front panel controls adjust the plot size to fit preprinted grids. Paper is secured in place by an electrostatic holddown system. Clean disposable pens are available in four colors.

The 7202A accepts serial, ASCII characters utilizing a brief and concise input format. All that is required is to add a few statements to your existing program. The plotter recognizes the following command mnemonics: PLTL — Plotter active, plots lines between coordinates; PLTP — Plotter active, plots points at coordinates; PLTT — Plotter inactive, does not accept data. Data is supplied as follows: X and Y coordinates are expressed as positive, four-digit numbers, less than or equal to 9999; X and Y coordinates are transmitted on one line separated by a space; the Y coordinate is followed by a carriage return, line feed, and six fill characters (fill characters can be any of 64 non-typing characters and are required at 300 baud only). Up Arrow (↑) immediately following the Y coordinate causes the 7202A to proceed to the next point with pen up in PLTL mode.

The 7203A accepts serial, binary data. It interprets the characters transmitted by the time-share system as binary position data. Four characters are used for the 7203A control: Plotter On — lower case w (Octal 167) — Plotter is enabled and remains on until Plotter Off Command received; Plotter Off — lower case s (Octal 163) — Plotter circuits disabled, remain off until Plotter On received; Pen Up — rubout (DEL) (Octal 177) — raises pen; Pen Down — left bracket ([) (Octal 173) — lower pen. Four characters are required for each move.

1. The numbers in bits 1 thru 6 indicate bit weight.
2. Bit 7 is used for synchronization.
3. The Plotter accepts data ranging from 0000 to 9999; any other data will cause an error indication.

To ensure maximum plotter efficiency, the time-share system must add null characters to some moves. This allows adequate time for completion of a move before starting another. Refer to Specifications for complete move length information.

7202A Specifications

Plotting area: Front panel scaleable from 12.7 × 12.7 cm to 25.4 × 38.1 cm (5 × 5 to 10 × 15 inches).
Paper size: Any size up to 27.9 × 43.2 cm (11 x 17 inches).
Plotting maneuvers: Plots lines or points.
Speed: Up to 105 Vectors per minute.
Numerical code: ASCII.
Plotting mode: Absolute coordinates.
Numerical resolution: 1/10,000 (0.001%).
Plot accuracy: Better than 0.076 cm (0.03 inch).
Resettability: 0.018 cm (0.007 inch) maximum.
Writing method: Ink, disposable pens.
Controls: Power, Chart Hold, Terminal Mute, Line/Local, Pen Down, Graph Limits.
Indicators: Power, Plot, Improper Format.
Interface – EIA RS232C: For other interfaces refer to 7202A — Interface guide P/N 5952-2768.
Move length: 3 inches maximum with pen down; 10 inches maximum with pen up.
Power requirements: 115/230 V ac, 48-400 Hz, 100 VA maximum.
Physical: Height: 216 mm (8½ inches)
Width: 508 mm (20 inches)
Depth: 511 mm (20⅛ inches)
Weight: 18.1 kg (40 lb)
Shipping weight: 23.6 kg (52 lb).

7203A Specifications

Plotting area: Front panel scaleable from 0 × 0 cm to 25.4 × 38.1 cm (0 × 0 to 10 × 15 inches).
Paper size: Any size up to 27.9 × 43.2 cm (11 × 17 inches).
Plotting maneuvers: Pen or Position. Pen and Position maneuvers are independent commands.
Speed: Up to 405 Vectors per minute.
Numerical code: Position data is received in Binary Format.
Plotting mode: Absolute coordinates.
Numerical resolution: 1/2500 (0.04%).
Plot accuracy: Better than 0.10 cm (0.04 inch) in 38.1 cm (15 inches).
Resettability: 0.18 mm (0.007 inch) maximum.
Writing method: Ink, disposable pens.
Controls: Line, Chart Hold, Mute, Line/Local, Pen Up, Pen Down.
Indicators: Power, Error, Plot.
Interface: — EIA RS232C:

Move length:

	10 CPS	30 CPS
Plotter units without additional null characters	2182	532
Additional units per null character	627	209

Power requirements: 100, 115, 200, or 230 V ±10%, 48 to 66 Hz; 100 VA maximum.
Physical: Height: 216 mm (8½ inches)
Width: 508 mm (20 inches)
Depth: 511 mm (20⅛ inches)
Weight: 18.1 kg (40 lb)
Shipping weight: 23.6 kg (52 lb).
Model number and name
7202A
7203A

Graphic recorders

Chart recorder supplies

The following supplies are those most frequently used in recording applications. A complete list of available supplies may be obtained by contacting your local Hewlett-Packard sales and service office.

X-Y recorder supplies

Graph paper, 21.6 cm × 28 cm (8½ in. × 11 in.):

Type	Plot Area	Weight	Part Number 100-sheet box
Metric	18 cm × 25 cm	light	9270-1027
		heavy	9270-1023
English	7 in. × 10 in.	light	9270-1007
		heavy	9270-1006

Graph paper, 28 cm × 41.9 cm (11 in. × 16½ in.):

Type	Plot Area	Weight	Part Number 100-sheet box
Metric	25 cm × 38 cm	light	9270-1042
		heavy	9270-1024
English	10 in. × 15 in.	light	9270-1005
		heavy	9270-1004

Disposable pens (one pen recorders):

Color	Part Number (package of 3)
Red	5081-1190
Blue	5081-1191
Green	5081-1192
Black	5081-1193

Disposable pens (two pen recorder — 7046A):

Color	Part Number (package of 3)
Red	5060-6662
Blue	5060-6664

Strip chart recorder supplies

Chart paper, 5-inch (680, 7143A):

Type	Description	Part Number
Ink Writing		
Metric	12 cm × 28.5 m	9270-1025
English	5 in. × 95 ft	9270-1012

Chart paper, 10-inch (7100B, 7101B, 7127A, 7128A):

Type	Description	Part Number
Ink Writing		
Metric	25 cm × 36 m	9270-1037
English	10 in. × 120 ft	9270-1010

Chart paper, 10-inch (7123A):

Type	Description	Part Number
Ink Writing		
Metric	25 cm × 28.5 m	9280-0176
English	10 in. × 95 ft	9280-0175

Chart paper, 10-inch (7130A, 7131A, 7132A, 7133A):

Type	Description	Part Number
Ink Writing		
Metric	25 cm × 30 m	9280-0265
English	10 in. × 100 ft	9280-0264
Thermal writing:		
Metric	25 cm × 24 m	9280-0289
English	10 in. × 80 ft	9280-0288
English, R.H. Soft Zero	10 in. × 80 ft	9280-0290

Chart paper, 12 cm (7155A):

Type	Description	Part Number
Ink Writing		
Metric	12 cm × 21.3 m	9280-0278
English	5 in. × 70 ft	9280-0277

Disposable pens (7123A, 7143A):

Color	Part Number (package of 3)
Blue	07143-60002
Red	07143-60003
Black	07143-60024

Disposable pens (7130A, 7131A, 7132A, 7133A):

Color	Part Number (package of 3)
Red	07130-62510
Blue	07130-62500

Disposable pens (7155A):

Color	Type	Part Number (package of 3)
Red	Main pen	07155-60014
Red	Event pen	07155-60015
Blue	Main pen	07155-60016
Blue	Event pen	07155-60017

Recording ink, 3 cc cartridge (680, 7100B, 7101B, 7127A, 7128A):

Color	Part Number
Red	1530-1024
Green	1530-1025
Black	1530-0705
Blue	1530-1034
Purple	1530-0984

Recording ink, 5 cc cartridge (7123A, 7143A):

Color	Part Number
Blue	07143-61701
Red	07143-61700
Black	07143-61702

Recording ink, 5 cc cartridge (7130A, 7131A, 7132A, 7133A Event Markers)

Color	Part Number
Red	5060-6506
Blue	5060-6505
Black	07130-60002

Instrumentation tape supplies

3M 951 tape ¼ inch, 1 mil, 2300 ft, HP P/N 9162-0006

Oscillographic recorder supplies

Chart paper

Recorder System	Description	Part Number
7402A	2 × 50 mm, 84 m (275 ft) roll	9280-0258
	1 × 100 mm, 84 m (275 ft) roll	9280-0276
	4 × 40 mm	9270-0878
7404A	4 × 50 DIV, 84 m (275 ft)	9280-0293
7404A	2 × 100 DIV, 84 m (275 ft)	9280-0294
7414A	500 sheet Z-fold pack 2 × 50 mm	651-52
7702B	96 m (200 ft) roll 8 × 40 mm	9270-0946
7418A	500 sheet Z-fold pack	

Recording Ink, cartridge:

Recorder System	Description	Part Number
7402A/7404A	Blue/Black, 85 cc	07402-60008