UITLEESEENHEID VOOR EEN FREQUENTIE GEMODULEERD SIGNAAL.

Rapport nr. 122.

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Laboratorium voor Scheepsbouwkunde.

Technische Hogeschool - Delft.

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Uitleeseenheid voor een frequentie gemoduleerd signaal.

Door M. Buitenhek.

Samenvatting.

In dit rapport wordt een apparaat beschreven dat het mogelijk maakt om electrische signalen met een wisselende amplitude en een wisselende frequentie in getal-vorm aan te bieden aan een digitale electronische rekenmachine.

De electrische signalen worden verwerkt met behulp van een frequentie gemoduleerde magneetband-recorder, de hierna beschreven teller en een papierband ponser.

Inleiding.

Daar het opmeten van een registratie van een onregelmatig fluctuerend verschijnsel (zie fig. 1) tijdrovend is, werd een apparaat ontwikkeld dat het analoge signaal omzet in een digitale registratie, welke verwerkt kan worden door een digitale rekenmachine.

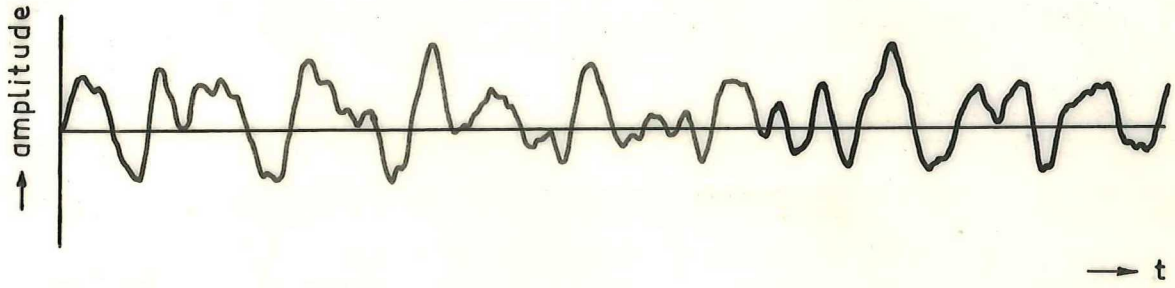

fig.1

De electrische signalen, bijv. afkomstig van de registratie van een watergolf of de, door de golven veroorzaakte bewegingen van een scheepsmodel,worden opgenomen op een frequentie genoduleerde magneetband-recorder. In tegenstelling tot het aangeboden analoge signaal (amplitude gemoduleerd) waaraan men een polariteit kan toekennen is dit met een frequentie gemoduleerd signaal niet mogelijk.

De in frequentie omgezette amplitude variaties gaan uit van een frequentieniveau, dat hoger of lager wordt met de amplitude van het aangeboden signaal.

Het amplitude gemoduleerde signaal uit fig. 1 is in fig. 2 getekend als een frequentie gemoduleerd signaal.

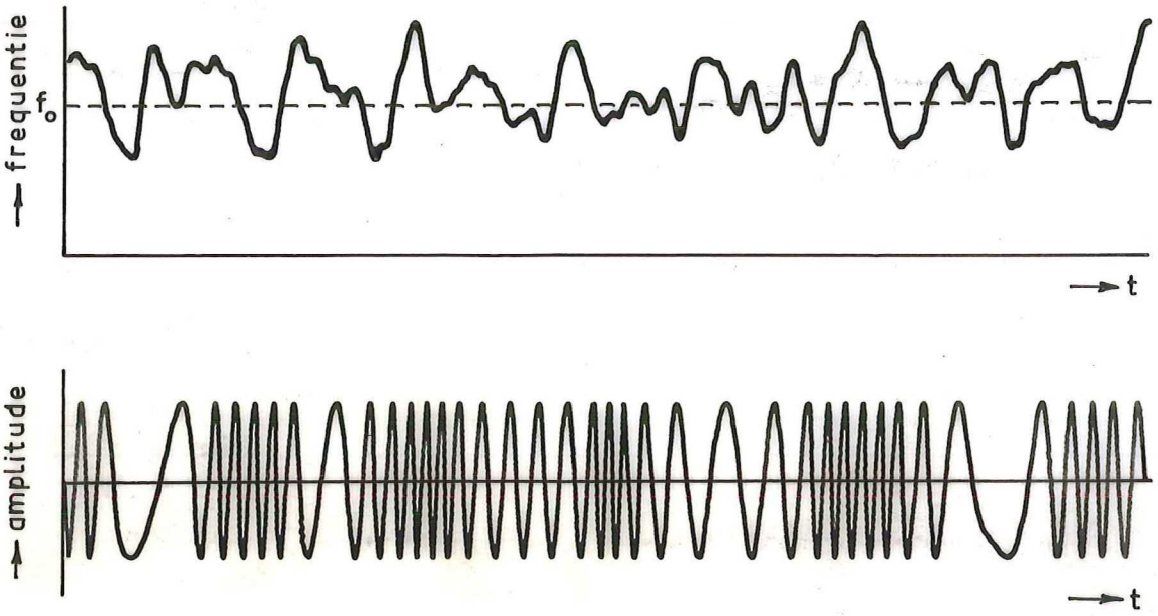

fig. 2

De rekenmachine zal later de gemiddelde frequentie van het aangeboden signaal moeten aftrekken van het aangeboden signaal. Het omzetten van het amplitude gemoduleerde signaal in een frequentie gemoduleerd signaal gebeurt in de magneetband-recorder. Het is mogelijk het van de weergave kop van deze recorder afkomstige frequentie gemoduleerde signaal per tijdseenheid te tellen. De hiervoor ontwikkelde teller is voorzien van een keuzeschakelaar voor het instellen van de teltijd in 10 stappen voor 0,01 sec tot 0,1 sec.

Tevens is een keuzeschakelaar aangebracht voor de in 10 stappen van 0,1 sec tot 1 sec in te stellen herhalingstijd. Dit is de tijd tussen twee tellingen.

Na het tel-gedeelte is een geheugen aangebracht, dat na elke telling het resultaat krijgt aangeboden. Hierdoor kan de ponstijd verkort worden, omdat dan het tellen en het ponsen tegelijk uitgevoerd kunnen worden.

In fig. 3 is de gang van zaken voorgesteld.

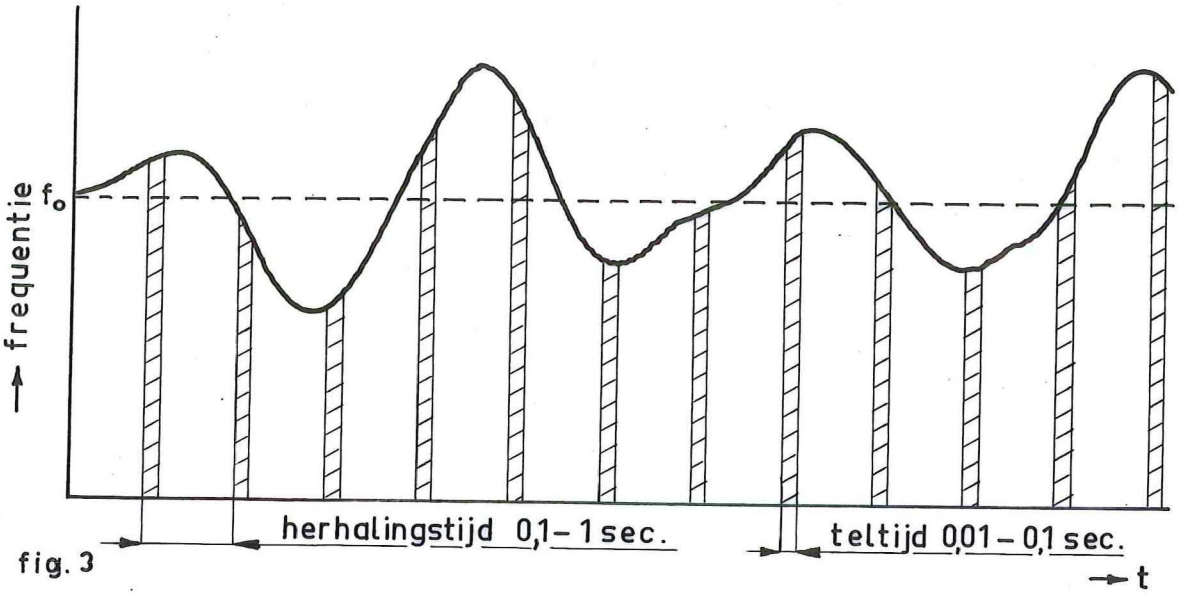

fig. 3

Bij gebruik van een meerkanaalsbandrecorder heeft men het voordeel dat de verschillende signalen gelijktijdig opgenomen worden. Doordat de kanalen één voor één uitgelezen worden en de afspeelsnelheid van de magneetband aangepast kan worden aan de ponssnelheid, kan van een eenvoudige ponser gebruik gemaakt worden.

Zet men op één kanaal een signaal met een constante frequentie dat pas aangesloten wordt bij het begin van een meting, dan liggen bij het uittellen van de signalen alle beginpunten gelijk, waardoor geen faseverschuiving tussen de verschillende signalen optreedt. Tevens wordt deze constante frequentie gebruikt als tijdbasis voor de teller.

Werking van het apparaat.

Het frequentie gemoduleerde meetsignaal, afkomstig van de magneetband-recorder gaat via een versterker TS 3, een pulsvormer TS 14 en een poort TS 16 naar de teller, die bestaat uit 3 tiendelers TS 11.

De 3 tiendelers zijn respectievelijk voor de honderdtallen, voor de tientallen en voor de eenheden. Wanneer de telling voltooid is, wordt het resultaat via een poortcircuit overgebracht naar een geheugen. Door gebruik te maken van een geheugen kan men de uitlees-

tijd verkorten door tellen en ponsen gelijktijdig uit te voeren. Na het geheugen volgt de code-omzetter voor het maken van een 1 - 2 - 4 - 8 - 16 code. In ons geval wordt met het getal 16 aangegeven dat een cijfer even is.

Dezelfde puls, die de telling overbrengt naar het geheugen, gaat naar de binaire unit TS 2 B van het besturingscircuit van de ponser.

Hierdoor wordt via een uitleesversterker TS 38 de "trip" spoel bekrachtigd die het ponssysteem in werking zet.

Het eerst geponste cijfer geeft het begin van een getal aan. Hiervoor kiest men een niet in de telling voorkomend cijfer, dus cijfer 10 t/m 15. Na deze ponsing geeft het synchronisatie-contact van de ponser een puls door aan een vierdeler, bestaande uit twee binaire units TS 2 A.

Deze vierdeler bedient achtereenvolgens een viertal poorten, waardoor de honderdtallen, tientallen en eenheden geponst worden. Na de vierde ponsing wordt het ponssysteem gestopt door een puls uit de vierdeler. In het besturingscircuit van de pons is een tweede binaire unit TS 2 B opgenomen die er voor zorgt dat de uitloopeinden van de papierband geen informatie bevatten.

Als tijdbasis wordt gebruik gemaakt van een 10 Kc crystal oscillator. Dit signaal wordt via de magneetband-recorder toegevoegd aan een versterker TS 3, een pulsvormer TS 14 en twee tiendelers TS 10. Het overblijvende signaal met een frequentie van 100 Hz wordt toegevoerd aan een tiendeler TS 11 met aftakbare tussenstanden voor 100 Hz tot 10 Hz, wat overeenkomt met 0,01 tot 0,1 sec. Hiermee wordt de teltijd ingesteld. De tweede tiendeler TS 11 geeft tussenstanden van 10 Hz tot 1 Hz, wat gelijk is aan 0,1 tot 1 sec. Deze tijden worden gebruikt voor het instellen van de herhalingstijd.

Het blokschema van de teller wordt gegeven in fig. 4.

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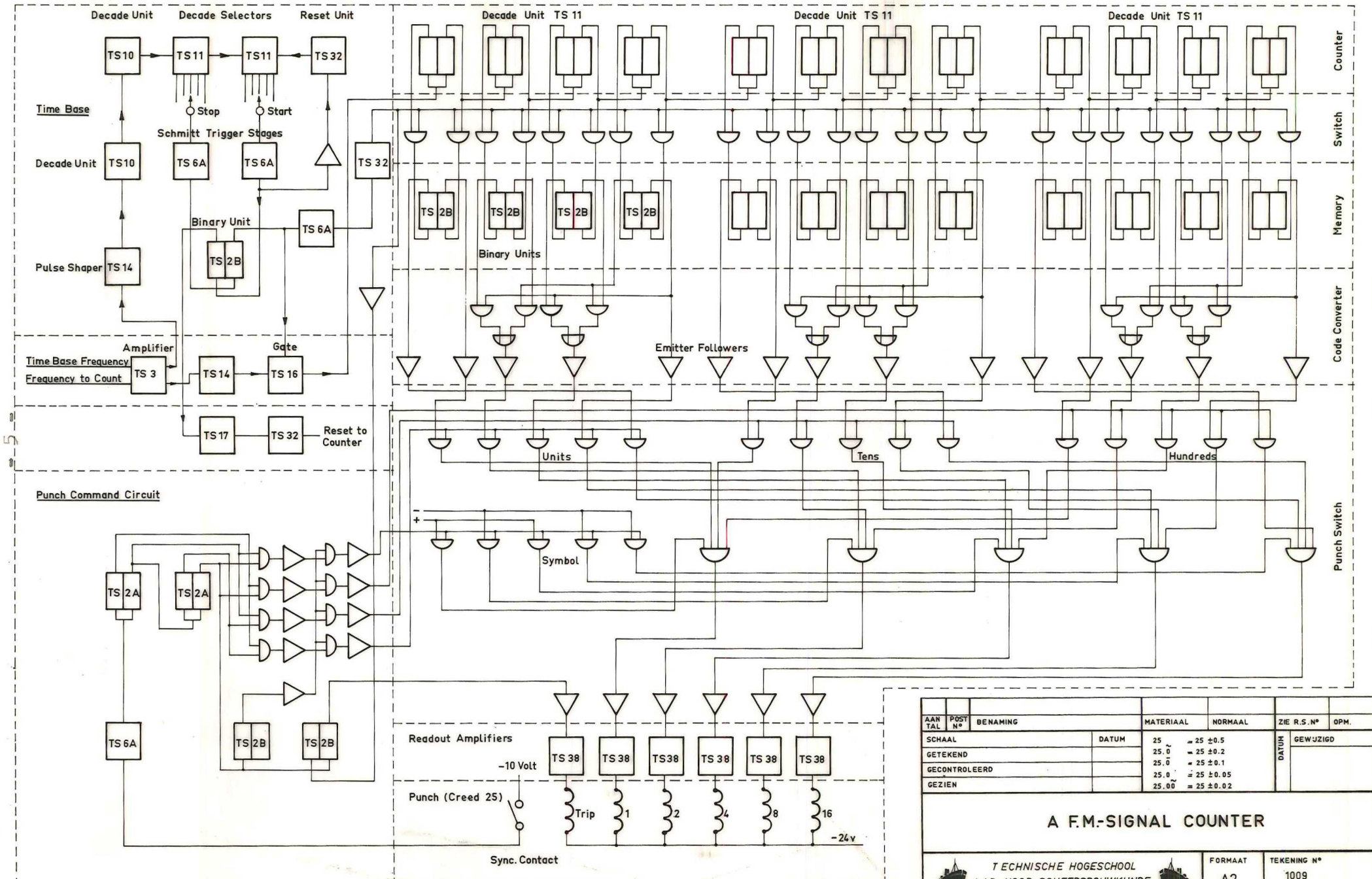


AANTAL	POST N°	BENAMING	MATERIAAL	NORMAAL	ZIE R.S.N°	OPM.
SCHAAL		DATUM	25 ≈ 25 ±0.5		DATUM	GEWIJZIGD
GETEKEND			25.0 ≈ 25 ±0.2			
GECONTROLEERD			25.0 ≈ 25 ±0.1			
GEZIEN			25.0 ≈ 25 ±0.05			
			25.00 ≈ 25 ±0.02			

A F.M.-SIGNAL COUNTER

TECHNISCHE HOGESCHOOL
LAB. VOOR SCHEEPSBOUWKUNDE
DELFT

FORMAAT	TEKENING N°
A2	1009
RANGSCHIK N°	

neg. 65-1045

voor-aanzicht digitale bandlezer

neg. 65-1044

boven-aanzicht telgedeelte

neg. 65-1046

boven-aanzicht uitleesversterkers en voedingsgedeelte

Gebruikte onderdelen.

TS 2 A en TS 2 B	Binary Units	Venner Electronics Limited
TS 3	Twin Wide Band Amplifier	
TS 5	10 Kc Crystal Oscillator	
TS 6 A	Selection Gate (Schmitt Trigger Stage)	
TS 10	Decade Unit	
TS 11	Decade Selector Unit	
TS 14	Pulse Shaper	
TS 16	Universal Gate	
TS 17	Twin Emitter Follower	
TS 20/c	Power Supply	
TS 32	Roset Unit	

Magneetband-recorder.

Precision Instrument PS - 214 A.

Pons apparaat

Creed 25.

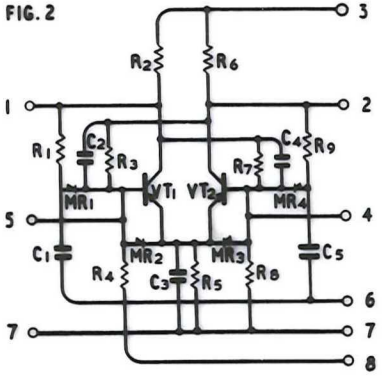
CIRCUIT DIAGRAM

INSTRUCTION LEAFLET

Transistorized BINARY UNITS

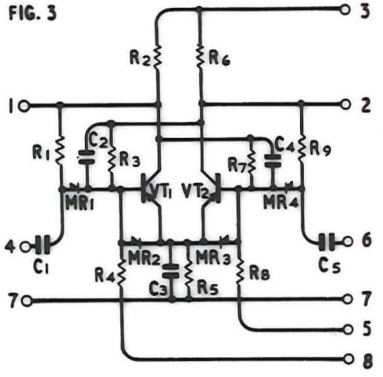
Type TS2A TS2B

FIG. 2



BINARY UNIT TYPE TS2A

FIG. 3



BINARY UNIT TYPE TS2B

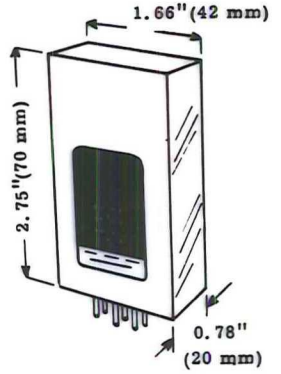
VENNER ELECTRONICS LIMITED

KINGSTON BY-PASS, NEW MALDEN, SURREY, ENGLAND. Telephone MALden 2442 (9 Lines)

Two types of Binary Stage are available, types TS2A and TS2B, the only difference between the stages being in the pin connexions which are provided, those for type TS2A being shown in Fig. 2, and those for type TS2B in. Fig. 3. (See circuit diagrams back page). Binary Unit TS2A is particularly suitable where a chain of stages is to be employed and feedback is to be applied. Both transistor base connexions are taken to pins permitting feedback to either half of the Binary Stage. Only one reset line is provided but this should be found to be sufficient for most applications since the output may be taken from either collector so that the open-circuiting of the leak resistor can either be used to produce a "Set 0" condition, or a "Set 1" condition depending on the wiring. Unit TS2B has both input leads available for use separately and permits two reset lines to be employed. It is especially suitable for use with Universal Gate type TS16 to give interlock action.

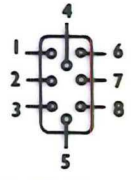
The recommended arrangement is as follows: If two Binary stages, type TS2B are used with the Universal Gate type TS16 as shown in Fig. 1, (page two), and both are reset as shown, a positive pulse fed to Pin 4 on the first Binary will open the Gate, and a similar positive pulse fed to Pin 6 on the second will close it. Similarly, if resistors are added external to the units so as to form a potential divider across the H. T. supply at each input, a momentary or continuous short circuiting of Pin 4 to earth on Unit 1 will open the Gate, and a similar short circuiting of Pin 6 to earth on Unit 2 will close it.

Joining Pin 4 on Unit 1 to Pin 6 on Unit 2 gives an arrangement where the first pulse received at the joined leads (after resetting) causes the Gate to be opened and the second causes it to be closed. No further pulses received affect the Gate.



Dimensions:
Figures refer to encased units.

Weight:
Encased: 2 oz. (57 gm).



Base Diagram (McMurdo XP8 Plug)

Pin	TS2A	TS2B
1	Output 1	Output 1
2	Output 2	Output 2
3	Supply neg.	Supply neg.
4	VT2 Base.	Input 1 ÷
5	VT1 Base	Set 1 *
6	Input	Input 2
7	Supply Pos.	Supply Pos.
8	Set 0 *	Set 0 *

*Normally joined to Pin 7
÷Join to Pin 6 for normal binary operation.

The combined gate circuit described can be used to feed Decade Counting stages type TS10, Decade Selectors type TS11, and Binary Units type TS2A or TS2B used in cascade.

INTERLOCKED PULSE-START PULSE-STOP CIRCUIT FOR UNIVERSAL GATE TS16

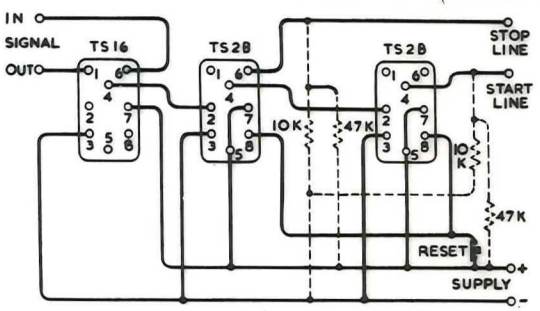


FIG. 1

APPLICATION NOTES:

(1) The reset lines of Binary Units may be joined to those of Decade Units.
(2) The momentary open-circuiting of Pin 8 to Pin 7 gives a 'Set 0' condition, that is, the collector connected to Pin 1 takes up a potential of approximately half the H. T. and that connected to Pin 2 a potential approximately equal to that of the H. T. line.
(3) The momentary open-circuiting of lead 5 from lead 7 produces a 'Set 1' condition, that is, the collector connected to Pin 1 takes up a potential approximately equal to that of the H. T., and that connected to Pin 2 to a potential of approximately half the H. T.
(4) Any number of Binary Units of either type may be connected in cascade, and TS2A units may be cascaded with type TS2B.
(5) (TS2A) To apply feedback a 820 pF capacitor should be connected from point of origin of feedback pulse to pin 4 or 5 as required.
(6) To ensure correct 'Resetting', (whether Binary Units are used alone or with Decade Units) a 3.3 Kilohm resistor should be connected between the Reset Line and Supply Negative.

IMPORTANT : (ENCASED STAGES)

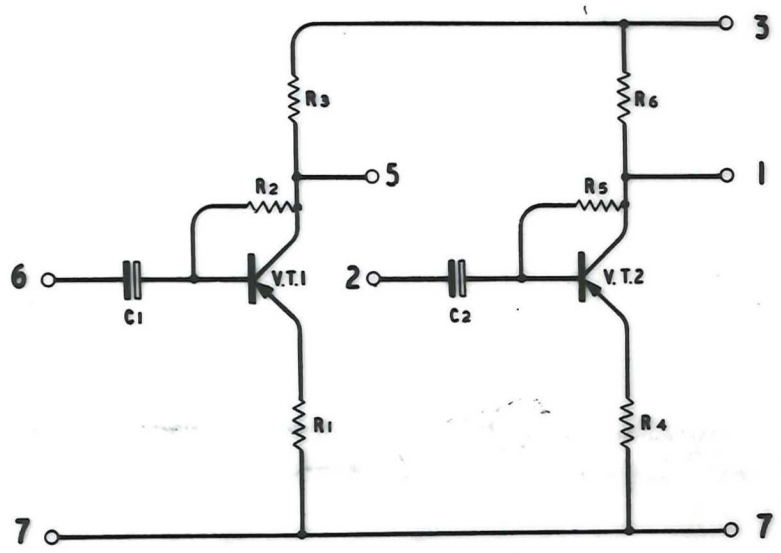
When attempting to remove the cover, it should be noted that the XP8 terminal plug is secured to the base by four screws which should not be removed as they do not secure the cover to the base. If a stage becomes faulty, it should be returned to Venner Electronics Ltd. for rectification.

Transistorized BINARY UNITS Type TS2A TS2B

SPECIFICATION.

FREQUENCY RANGE:	Random to 30 K. p. p. s. For higher frequencies (up to 1 M. p. p. s) type TS2HF should be used.
TEMPERATURE RANGE:	-10°C to 50°C
SUPPLY:	10V D. C. nominal. Satisfactory operation is generally obtained with supplies of 6 - 12 V.
POWER CONSUMPTION:	30 mW with 10V supply.
INPUT:	Pulse or squarewave of 4V peak or greater. (Note: The stages trigger on the positive edge of a pulse, i. e. the leading edge of a positive pulse or the trailing edge of a negative one).
Minimum pulse widths:	Positive Pulses: Not less than 0.75 µS (4V amp). Not less than 0.25µS (10V amp). Negative Pulses: 15µ S (4V amplitude). 3.5 µ S (10V amplitude).
Rise times:	Not greater than 6 µS (4V amplitude). Not greater than 12 µS (5V amplitude). Not greater than 25 µ S (10V amplitude). (A linear rate of rise is assumed in the above).
INPUT IMPEDANCE:	2KΩ (Very approximately). Note: For operation by signals of sinewave form, the stage should be preceeded by a shaping amplifier such as type TS14.
OUTPUT:	Two anti-phase outputs available, one from each collector. Minimum D. C. load resistance = 30 KΩ. Minimum A. C. load impedance = 2 KΩ.
FINISH:	Encased units are normally supplied. Resin encapsulated units can be made to order.
CONNECTOR:	The plug mounted on the unit is intended for use with socket type XS8, made by the McMurdo Instrument Company.

CIRCUIT DIAGRAM



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VENNER ELECTRONICS LIMITED
INSTRUCTION LEAFLET

Transistorized WIDE BAND AMPLIFIER Type TS3

This amplifier has been designed for use in applications where a flat response over a wide frequency range is required. The amplifier consists of two R. C. coupled stages which may be used either singly or cascaded, as the case may be. The individual stages are flat within 3db from 15 c/s to 200 kc/s and have a voltage gain of approximately 60. With both stages cascaded the response is within 3 db from 15 c/s to 125 kc/s and the voltage gain is approximately, 1,000. It should be borne in mind that the gains quoted here are when feeding into a high impedance load and the figures will necessarily vary depending upon the application.

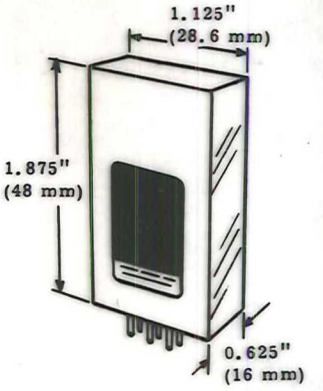
Two R. F. transistors are used and a temperature compensation circuit is employed so that the stage functions satisfactorily up to 50°C. This amplifier is ideal for most industrial applications, especially where pulse or square waveforms are required to be amplified.

IMPORTANT NOTE.
NON-ENCAPSULATED STAGES.

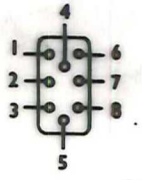
When attempting to remove the cover, it should be noted that the XP8 termination plug is secured to the base by four screws which should not be removed as they do not secure the cover to the base. If a stage becomes faulty, it should be returned to Venner Electronics Limited for rectification.

WIDE BAND AMPLIFIER

Type **TS 3**



Weight: $\frac{3}{4}$ oz. (21.5 gm)



Base Diagram (McMurdo XP8 Plug)

Pin
1. Output (stage 2).
2. Input (stage 2).
3. Supply negative.
4. Unused.
5. Output (stage 1). Join to Pin 2 to cascade stages.
6. Input (stage 1).
7. Supply positive. (10V nominal). "Earthy" line.
8. Unused.

APPLICATION NOTES:

(1) Since the amplifier gain extends up to radio frequencies it is essential to screen the input lead efficiently.

(2) Screening between input and output leads must be efficient otherwise oscillation will result.

(3) At the low frequency end of the spectrum, precautions must be taken to prevent motor-boating which will occur if the power supply has a high internal resistance.

(4) If gain is required of the same order as that given by the TS3 but over a more restricted frequency band, then amplifier type TS4 should be used. TS4 is easier to use as it is less affected by the effects detailed in the above notes.

(5) The gains stated are measured with the amplifier driving a high impedance (greater than 100 KΩ) and these will not be obtained if the amplifier is used to drive another transistor stage unless an emitter follower (TS17) is used as an impedance convertor.

(6) The output may be taken via a capacitor from the collector of the transistor, or, if a pen recorder or earphones are to be driven, the winding may be connected directly in parallel with the collector load. If this is done, however, the D.C. conditions will be upset and the temperature compensation circuit will be altered, particularly if the winding resistance is small compared with that of the collector load (3.3KΩ). The minimum permissible value for the winding resistance is 100Ω.

(7) The output power available is only a few milliwatts as the TS3 is intended as a low-level voltage amplifier and not as a power amplifier.

Transistorized WIDE BAND AMPLIFIER Type TS3

SPECIFICATION.

SUPPLY VOLTAGE:	Nominally 10V. Unit functions satisfactorily with supplies of 1.5V to 12V.
FREQUENCY RANGE:	Flat within 3 db, 15 c/s to 200 kc/s (single stage). " " " " 15 c/s to 125 kc/s (two stages cascaded).
VOLTAGE GAIN:	Single stage: Approx. 60 for 10V supply. Two stages : Approx. 900/1000 for 10V supply. (Into high impedance load).
MAXIMUM OUTPUT:	2V R.M.S. with 10V supply.
POWER CONSUMPTION:	15 mW at 10V (each half).
INHERENT NOISE:	Open circuit input 6 μV. Short circuit input 2 μV.

Variation of Gain with temperature and input amplitude. (See below).

IMPEDANCES:	Input: 2 KΩ (approx) at 1 kc/s. Output: 3 KΩ (approx) at 1 kc/s.
FINISH:	Unit is mounted in removable plastic case.
CONNECTOR:	The plug mounted on the unit is intended for use with socket type XS8, made by the McMurdo Instrument Company.

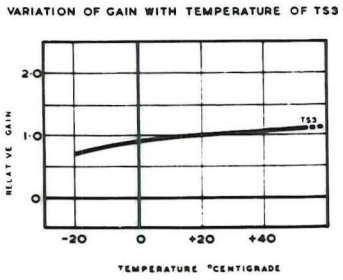


FIG. 1

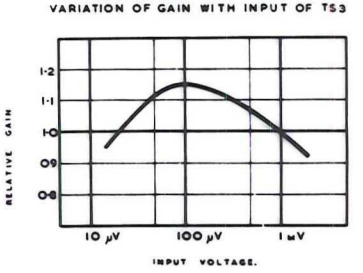
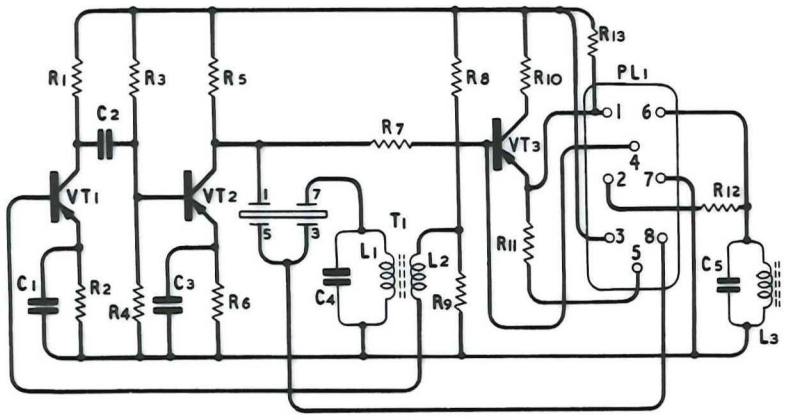


FIG. 2

Transistorized 10 Kc/s CRYSTAL OSCILLATOR Type TS5



NOTE: NOS. ON CRYSTAL REFER TO CONNEXIONS ON B 7G BASE

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TS5/6010

CIRCUIT DIAGRAM

VENNER ELECTRONICS LIMITED
INSTRUCTION LEAFLET

Transistorized 10 Kc/s CRYSTAL OSCILLATOR Type TS5

This unit provides a trapezoidal and a sinewave output of high stability. The waveforms are derived from an oscillator circuit employing two transistors and an XY flexure quartz crystal. The output from the oscillator circuit is fed to an emitter follower to provide a low source impedance. The latter stage provides for some measure of gating inasmuch as connexions are brought out to the multi-pin plug so that the emitter follower is fed when Pin 5 is joined to Pin 7 but not when there is no connexion (except to sinewave, no connection needed, but no gating). Conversely, the emitter follower is not fed when Pin 4 is joined to Pin 7 but is when they are open-circuited. This is a useful feature when constructing timing equipment.

The trapezoidal output from the TS5 is ideally suitable for feeding directly to decade or binary dividers or counting chains.

APPLICATION NOTES

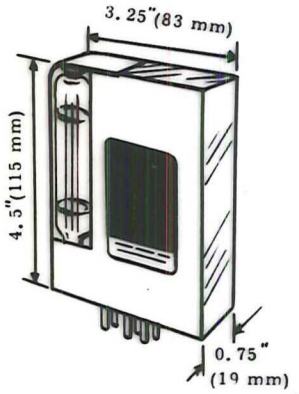
(1) Setting up frequency: An external 200 pF var-capacitor should be connected between pins 7 and 8, and the unit may then be adjusted against a precision standard. Alternatively a fixed 50 pF capacitor may be connected in place of the variable. The nominal accuracy with this arrangement is ± 0.010%.

(2) Choice of Crystals. As the crystal is not oven controlled, the stage can be supplied with either of two Marconi crystals.

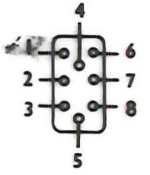
(i) A crystal having a zero temperature coefficient between 40°C and 50°C for high temperature operation.

10 Kc/s CRYSTAL OSCILLATOR

Type TS 5



Weight: 10½ oz. (300 gm).



Base Diagram (McMurdo XP8 plug)

Pin.

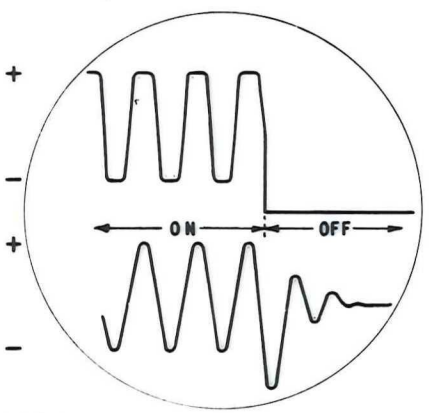
1. Output (Trapezoidal)
2. Join to Pin 1 for sinewave
3. Supply negative.
4. Gating Pin. Join to Pin 7 for no output.
5. Gating Pin. Join to Pin 7 for output.
6. Output (Sinewave).
7. Supply positive. "Earthy".
8. Tuned Capacitor connexion. (100 pF variable between Pins 7 and 8.)

(ii) A crystal with a zero temperature co-efficient between 15°C and 20°C for normal ambient conditions.
For frequency tolerances please refer to specification.

(3) Gating. As previously mentioned, base connexions are arranged so that a squarewave output is obtained if Pin 5 is joined to Pin 7 but not if these pins are open-circuited(provided that no alternative D. C connexion is available from Pin 1 to Pin 7). Conversely an output is available if Pins 4 and 7 remain open-circuited but not when they are connected together.

The squarewave output from Pin 1 can be cut off immediately by the above means, but the sinewave output from Pin 6 will have a decay period of two or three cycles. (See Fig. 1).

Sinewave may be gated at pins 5 and 7, provided pins 1 and 2 are a. c. coupled by a capacitor of 0. 01 µF or larger.



EFFECT OF INTERNAL GATING CIRCUIT ON SQUARE AND SINEWAVE OUTPUTS.

THE OVERSWING AND DECAY TIME OF THE SINEWAVE OUTPUT PROHIBITS THE USE OF THE INTERNAL GATING FOR SOME APPLICATIONS.

FIG. 1

IMPORTANT NOTE
NON-ENCAPSULATED STAGES

When attempting to remove the cover, it should be noted that the XP8 termination plug is secured to the base by four screws which should not be removed as they do not secure the cover to the base. If a stage becomes faulty, it should be returned to Venner Electronics Limited for rectification.

Transistorized 10 Kc/s CRYSTAL OSCILLATOR Type TS5

Crystal Oscillator Serial No: 15103 tunes with 59 pF.

SPECIFICATION

FREQUENCY: 10 kc/s. Adjustable by an external capacitor to an accuracy dependent upon temperature and setting. With fixed 50 pF capacitor, nominal accuracy ± 0. 01%.

TEMPERATURE RANGE: -10°C to 50°C.

FREQUENCY TOLERANCE:

TS5/1.	22°C to 34°C - approx.	16 parts/ million
	34°C to 50°C - approx.	3 parts/million
TS5/2.	15°C to 25°C - approx.	3 parts/ million
	30°C to 40°C - approx.	16 parts/ million

OUTPUTS: (1) A trapezoidal waveform of 7V peak-to-peak amplitude, having a rise time of approximately 10 µS (14 µS for 6V supply, 10 µS for 10V supply, 8 µS for 12V supply). This output is provided via an emitter follower to give a source impedance of approximately 600Ω but the minimum load is 2. 2 KΩ. The trapezoidal output is ideally suitable for feeding directly to a Decade.
(2) A sinusoidal output is also available, the waveform being present across a tuned circuit and therefore having a very good waveshape. The amplitude of the sinewave is 5. 6V peak-to-peak on open circuit and 2. 8V peak-to-peak when fed into a load of 18 KΩ. The minimum permissible load is 18 KΩ to maintain a good waveshape.

GATING: See Application Notes.

SUPPLY: 6V to 12V (10V nominal).

CONSUMPTION: 90 mW at 10V.

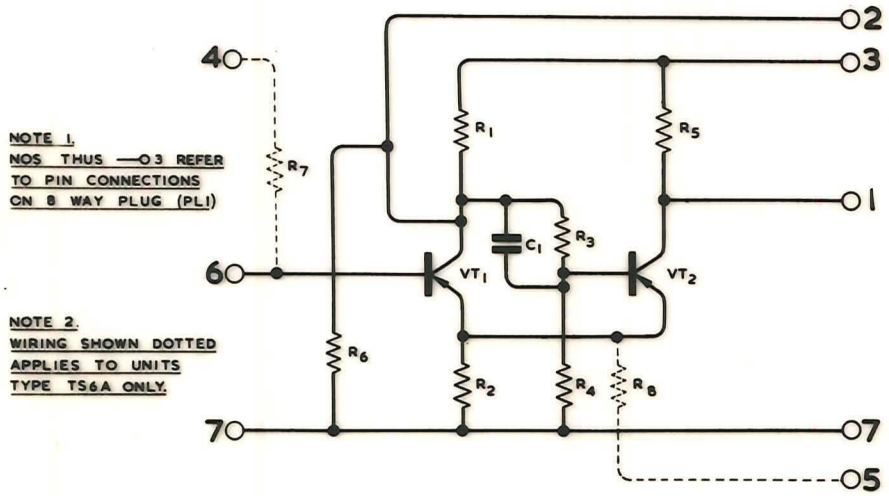
FINISH: The unit is encapsulated in resin with the exception of the crystal which is mounted on a B7G plug in base.

CONNECTOR: The plug mounted on the unit is intended for use with socket type XS8 made by the McMurdo Instrument Co.

CIRCUIT DIAGRAM

VENNER ELECTRONICS LIMITED
INSTRUCTION LEAFLET

Transistorized SELECTOR GATE
(Schmitt Trigger Stage)
Type **TS6 TS6A**



NOTE 1.
NOS THUS —O3 REFER TO PIN CONNECTIONS ON 8 WAY PLUG (PL1)

NOTE 2.
WIRING SHOWN DOTTED APPLIES TO UNITS TYPE TS6A ONLY.

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Transistorized SELECTOR GATE (Schmitt Trigger Stage)
Type TS6 TS6A

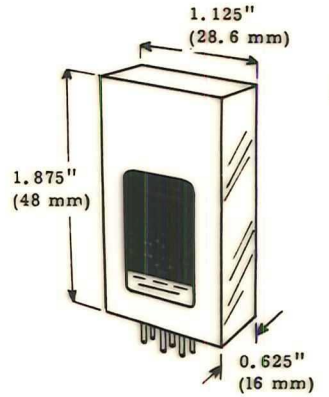
This unit is basically a two transistor Schmitt trigger circuit. The operation is such that the state of the circuit depends on the d.c. level of input. When the input is below the trigger level the circuit remains in the "rest" condition with VT1 cut off and VT2 conducting. (See diagram on back page). When the input rises above this level the circuit switches to the other condition with VT1 conducting and VT2 cut off. It will remain in this state until the input once more falls below the trigger level when it will reset to the rest condition.

The input voltage at which the circuit triggers to the "OFF" condition is slightly lower than that at which it triggers to the "ON" condition.

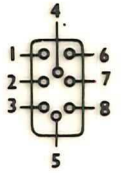
IMPORTANT NOTE.

NON-ENCAPSULATED STAGES.

When attempting to remove the cover, it should be noted that the XP8 termination plug is secured to the base by four screws which should not be removed as they do not secure the cover to the base. If a stage becomes faulty, it should be returned to Venner Electronics Limited, for rectification.



Weight: $\frac{3}{4}$ oz. (21.5 gm)



Base Diagram (McMurdo XP8 Plug)

Pin No.
1. Output 1. Neg. going.
2. Output 2. Pos. going.
3. Supply negative.
4. Input 2 (TS6A).
5. Join to Pin 7 on TS6A* (Use Input 2).
6. Input 1.
7. Supply Pos. (earthy).
8. Not used.

* To reduce input differential.

APPLICATION NOTES.

(1) Two outputs are available. Output 1 is negative going when triggered to the "ON" condition; Output 2 is positive going when triggered to the "ON" condition. Output 1 should be used whenever possible, as this has the more rapid switching action.

(2) **Two versions of the stage are available: TS6 and TS6A. Both units have identical basic circuits, but the TS6A has connexions available at the base to enable the voltage differential between the 'ON' and 'OFF' trigger levels to be reduced. (See Specification).**
The impedance of the input source should be kept as low as possible. With the lower differential connexion of the TS6A it should not exceed 10 KΩ.

(3) Due to the rapid change in circuit conditions, when the stage is triggered, the output is ideal for triggering Binary and Decade Units. The advantage of the TS6 over the standard pulse shaper is that a sharp output is produced for even the slowest rate of change of the input.
By using a TS6 as a shaper between the output of a photohead type TS12 and the input of a decade counter, the decade will register the number of times the light beam to the photohead is broken no matter how slowly this is done.

The TS6 can also be used in most applications where it is necessary to produce a rectangular waveform from some other periodic waveform. It may also be employed in the output circuit of a Decade Selector type TS11 (for further details refer to Instruction Leaflet TS11) providing pin 8 is connected to pin 7. (Pin 8 is shown as not used in the list of pin numbers on the front page).

(4) When setting up the stage it is necessary to ensure that the correct potential occurs at the input to the TS. 6. If d. c. coupling to the previous stage is to be employed, then a potential divider across the previous output, with the TS. 6 input tapped in at the appropriate point, can be used. If a. c. coupling is used and the signal amplitude is insufficient to allow the input of the TS. 6 to be grounded, then a potential divider across the supply lines can be used to bring the input potential to near the triggering level. In this case it should be remembered that the effective impedance presented to the source will be the input impedance of the TS. 6 in parallel with the effective impedance of any biasing system used.

Transistorized SELECTOR GATE (Schmitt Trigger Stage) Type TS6 TS6A

SPECIFICATION

TS6A is now normally supplied as standard

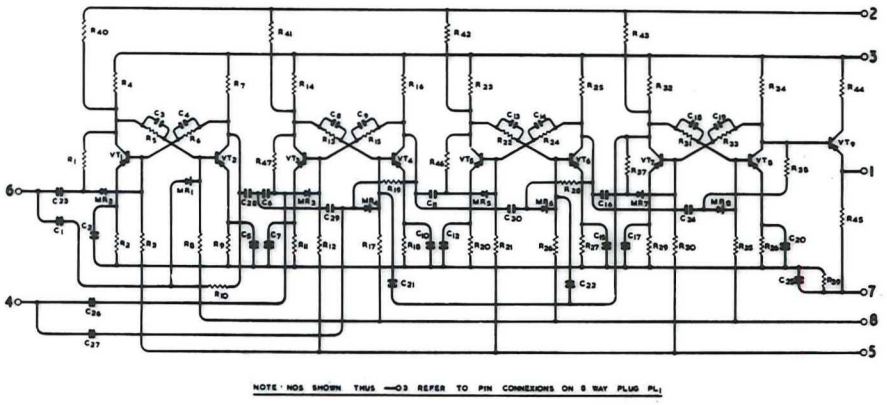
TRIGGERING POTENTIALS:	TS6 : 'ON' -3.5V to -2.5V 'OFF' -2V to -3.0V TS6A: 'ON' -1.2V to -1.8V 'OFF' -1V to -1.6V } 10V supply (at 25°C) (Connect pins 5 and 7 together and use Input 2 - Pin No. 4)
DIFFERENTIALS:	TS6 : 0.6V TS6A: 0.2V } 10V supply (at 25°C)
SUPPLY:	6V to 12V (10V nominal)
TEMPERATURE:	-10°C to +50°C.
CONSUMPTION:	2 mA VT1 on 3 mA VT1 off (triggered) } 10V supply.
FREQUENCY:	30 kc/s maximum.
IMPEDANCE:	Input: 5 KΩ Output: 4.7 KΩ. Note: The input source impedance should be kept as low as possible. (With the lower differential connexion of the TS6A it should not exceed 10 KΩ.)
FINISH:	Unit mounted in removable plastic case.
CONNECTOR:	The plug mounted on the unit is intended for use with socket type XS8 made by the McMurdo Instrument Company.

Transistor DECADE UNIT Type TS10/5

CIRCUIT DIAGRAM

VENNER ELECTRONICS LIMITED
INSTRUCTION LEAFLET

Transistor DECADE UNITS
Types **TS10 TS10/5**
STANDARD and MF.



DECADE UNIT Type TS 10/5

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Transistor
DECADE UNITS Types TS10 TS10/5 TS10/5MF

The Venner Decade Unit has been developed to fulfil a need for a fundamentally stable divide-by-ten and/or counter stage which is thoroughly reliable, is small in size and has a low power consumption. It has a potential life far greater than any valve operated Decade.

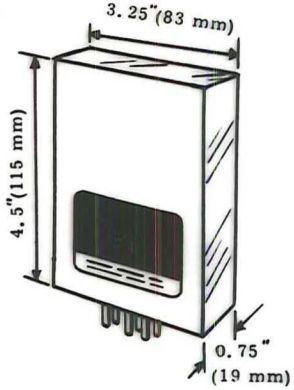
Although the stage is subjected to negligible internal heating, temperature compensation has been incorporated in the circuit design. There is some fall off in maximum frequency response at high ambient temperatures, however. (See specification).

The units dealt with in this instruction leaflet are suitable for maximum operating frequencies of 30 kc/s (TS.10 and TS10/5) and 100 kc/s (TS10/5MF). For higher frequencies (up to 1 Mc/s) type TS10/5HF should be used. (This stage is the subject of a separate instruction leaflet).

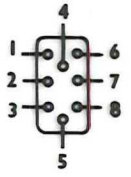
The Venner Decade Unit consists of four Binary stages with feedback incorporated to reduce the natural count of sixteen to ten. In addition, all Decades of recent manufacture incorporate an emitter follower output stage.

Unit TS10/5 or TS10/5MF has an additional lead brought out to pin 4, so that it may also be used as a divide-by-five stage. The latter type of unit is now normally supplied as standard.

For applications where a scale-of- sixteen divider is required, the Decade Selector, TS. 11 should be employed.



Weight:
encased: 5½ ozs. (150gm)
encapsulated: 11½ ozs. (325gm)



Base Diagram (McMurdo XP8 plug)

Pin.
1. **Output.**
2. **Meter + (Counter only).**
3. **Supply negative.**
4. **Input (÷ 5) TS10/5 only).**
5. **Reset 9. (normally join to Pin 7).**
6. **Input (÷10).**
7. **Supply positive (Earthy).**
8. **Reset 0. (Normally join to Pin 7).**

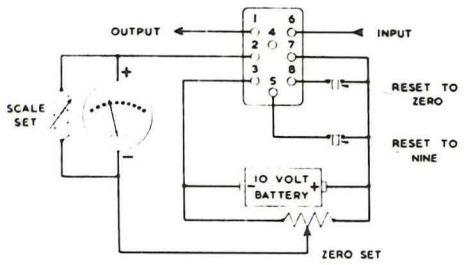


FIG. 5.
A unit employed as a counter. Here the meter acts as an indicator of the total count. The only additional components required are shown. When in operation the meter will move across the scale one "step" for each input pulse.

The connexions are shown in Fig. 5, the potentiometers being for zero setting. Pin 2 is connected via resistors to each Eccles-Jordan stage so that if the meter is connected between it and a potentiometer wired across the supply, a discrete "step" increase in current occurs for each input pulse. This occurs for 1-9 pulses but the tenth causes a "carry" pulse to be produced and the meter current suddenly falls to zero. A meter calibrated 0 - 9 will thus indicate the count at each Decade. If the input is too fast for the meter to follow, the needle remains at $4\frac{1}{2}$ until the train of pulses has ended, when the needle will take up a position corresponding to the current caused to pass by the last input pulse. The meter should have a F.S.D. of 500μA or less. 250μA meters are very suitable as regards electrical and mechanical construction and meters down to 50μA may be used if required. The cascading of the units is carried out as for the divider application. (NOTE: A stabilized power supply is desirable for counter applications).

3. INPUT WAVEFORM (See also Specification).

As previously mentioned, the input should take the form of squarewave or pulses of rectangular shape, the rise time being as short as possible. With pulse waveforms, positive pulses give the most reliable operation.

If a shaping amplifier is not used to precede the first decade stage, the input amplitude must be set carefully, but one setting in the range of 0.4Vs*and 0.8Vs will be satisfactory over the whole frequency range. (* supply voltage).

A shaping amplifier, type TS14 is available which will accept waveforms of square, sine or pulse shape having amplitudes between 0.5V - 10V peak. In this case, inputs varying in amplitude will feed the decade correctly over the whole frequency range.

The trapezoidal output from Venner crystal oscillator units types TS5 and TS25 is eminently suitable for driving decade stages without shaping, but the output from the 1,000 c/s L-C Oscillator type TS1 is not suitable for direct application to decades.

SPECIFICATION.

	TS.10, TS10/5.	TS10/5 MF.
FREQUENCY RANGE:	Random to 30 kc/s.	Random to 120 kc/s.
SUPPLY:	6-12V (10V nominal).	6-12V (10V nominal).
TEMPERATURE:	-10°C to +50°C.	-10°C to +50°C.
(Note:	Upper frequency limit falls to 20 kc/s at 40°C and to 10 kc/s at 50°C).	(Upper frequency limit is maintained over the whole of this temp. range).
INPUT:	4-10V pulse or sq. wave.	4-10V pulse or sq. wave.
Min. pulse widths.	0.5 μS positive going.	0.2μ S positive going.
	30 μS negative going.	3 μS negative going.
METER:	250 μA calibrated 0-9.	250 μA calibrated 0-9.
CONSUMPTION: (Scaler)	180 mW 200 mW	180 mW) 10V supply.
(Counter)	200 mW 220 mW	200 mW)
IMPEDANCES: (Input)	2 KΩ	2 KΩ approximate
(Output)	1 KΩ	1 KΩ) figures.
ASSOCIATED STAGES:		
Shaping Amplifier:	TS.14	TS.14
Universal Gate:	TS.16.	TS.16
Binary Stages:	TS2A, 2B.	TS2B/HF
Resetting Units:	TS13, TS32.	TS13, TS32.

OUTPUT: A pulse is available from each decade unit for injection into a following unit if fitted. No shaping amplifier is necessary between stages.

RESET TO ZERO: The momentary operation of a pushbutton or relay breaking normally closed contacts will reset all stages to zero. A 1KΩ to 3KΩ resistor should be connected from Pin 8 to Pin 3 if several TS.10 or TS.2 units are used. (Number of stages immaterial). A contactless electronic reset unit, type TS.32 is available, capable of resetting decade and binary stages in less than 4 μS.

RESET TO NINE: The momentary operation of a pushbutton or relay breaking normally closed contacts will reset all stages to nine. (For ease of adjustment of "scale set" control in counter applications).

FINISH: Standard: Encased. (Unit can be encapsulated in resin).

CONNEXIONS: The plug mounted on the unit is intended for use with socket type XS8 made by the McMurdo Instrument Company.

APPLICATION NOTES.

1. USE AS A DIVIDER.

When the stage is used purely as a divider all that is required is a D.C. supply of between 4 and 11V (which does not need to be stabilized) and linking wires between the pins. (See Fig. 1). The input should take the form of a square wave or pulses of rectangular shape. It will be noted that in this divider application Pin 2 is not employed. In fact, this connexion is provided to permit meter indication if the stage is used as a counter. The normal output waveform which occurs at Pin 1 is shown in diagram. This waveform is ideally suitable for connecting to the input of another Decade Unit. No shaping amplifier is required between units and a "carry" pulse will correctly index the next Decade even though the supply voltage may vary between wide limits.

Decades of different types, i.e. TS.10, TS10/5, and TS10/5MF and binary stages can all be cascaded together, no special precautions being required.

Note: TS.10 or TS 10/S will not drive TS 10/S MF.

FIG. 1
A single stage in use as a divider.

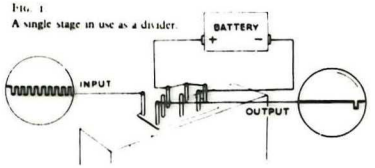
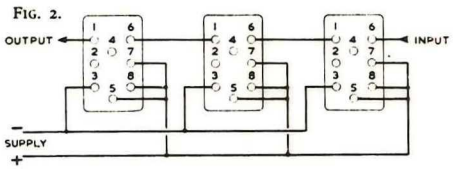


FIG. 2.



The connexions required when several dividers are used in cascade are shown in Fig. 2. Power supply requirements are modest and the assembly of several units to form a divide-by-hundred or divide by 1000 chain is extremely simple since inter-linking of the socket pins is all that is required.

2. USE AS A COUNTER.

For counter applications use is made of the "staircase" waveform which is present at Pin 2 (see fig. 3), for operating a meter as an indicator, and the normal output waveform which occurs at Pin 1 (see fig. 4). The latter used as a "carry" pulse will correctly index the next counter stage, where two or more decades are cascaded.

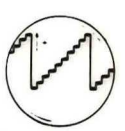
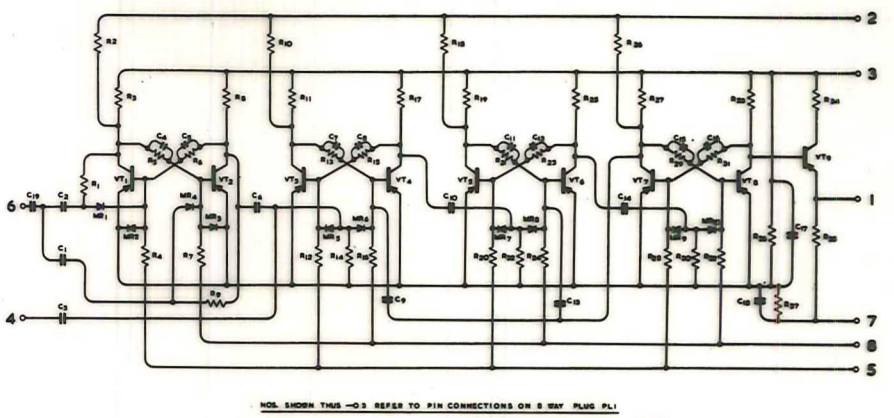


FIG. 3.
Staircase waveform available at Pin 2.

FIG. 4.
Output waveform available at Pin 1.



DECADE UNIT Type TS 10/5MF

IMPORTANT NOTE.

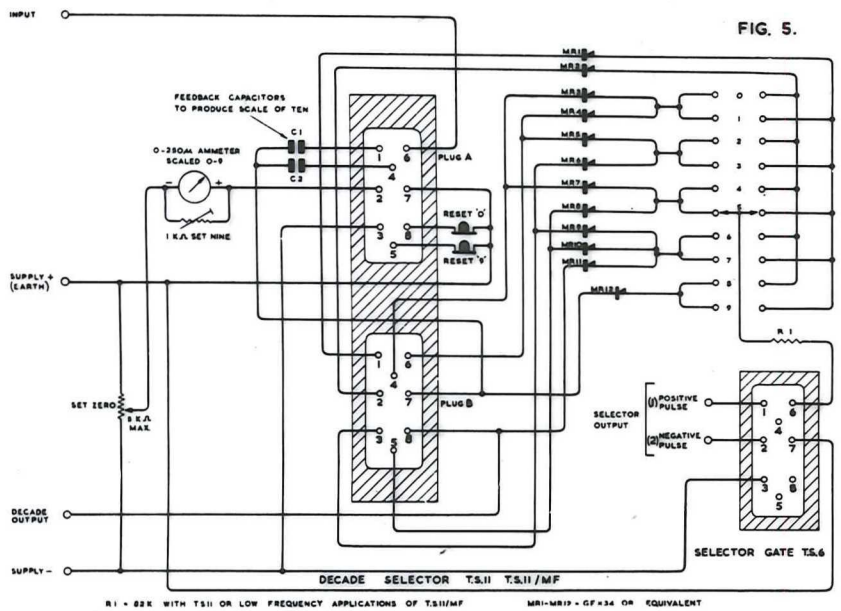
NON-ENCAPSULATED STAGES.

When attempting to remove the cover, it should be noted that the XP8 termination plug is secured to the base by four screws which should not be removed as they do not secure the cover to the base. If a stage becomes faulty, it should be returned to Venner Electronics Limited for rectification.

VENNER ELECTRONICS LIMITED
INSTRUCTION LEAFLET

Transistor
DECADE SELECTOR UNIT
Type **TS11 TS11/MF**

FIG. 5.



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Transistor DECADE SELECTOR UNIT Types TS11 TS11/MF

These units have the same basic circuits as the Decade Counters, types TS10 and TS10/MF but, in addition all transistor collectors are brought out to pins on the base, necessitating two 8-pin plugs.

The Decade Selector is intended to perform a function similar to that of a Dekatron tube but in addition the plug connexions have been arranged so that the four binary stages may be used without feedback to give a scale-of-sixteen.

By using TS11 type units in conjunction with ten-position selector switches and also in conjunction with the Selector Gate type TS6, it is possible to select an output pulse at any predetermined count.

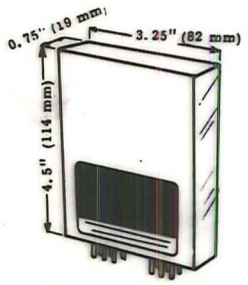
Thus the TS11 is of use in "batch counting" applications and also for the operation of "less than minimum" or "more than maximum" count alarm circuits. A further application is to drive power read-out stages for operation of optical in-line digital indicators and print-out devices.

APPLICATION NOTES.

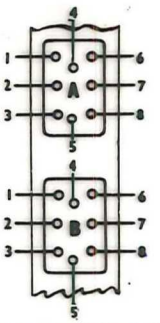
1. USE AS A COUNTER OR DIVIDER.

TS11 and TS11/MF units can be used as counters and dividers in exactly the same way as TS10 and TS10/MF units. Input signal and power requirements, and temperature and frequency limitations are identical.

If it is desired to use the stage as a scale of sixteen then the output should be taken from Plug B, Pin 8. If it is required to convert the TS11 to a scale-of ten, then a 1000 pF capacitor should be connected between Pin 1 on Plug A and Pin 7 on Plug B and a second 1000 pF capacitor should be connected between Pin 4 on Plug A and Pin 7 on Plug B. The output should be taken from Pin 8 on Plug B as before.



Weight:
encased: 5½ ozs. (150gm)
encapsulated: 11½ ozs. (325gm)



Base Diagram (Two McMurdo XP8 plugs on 1.593" Centres)

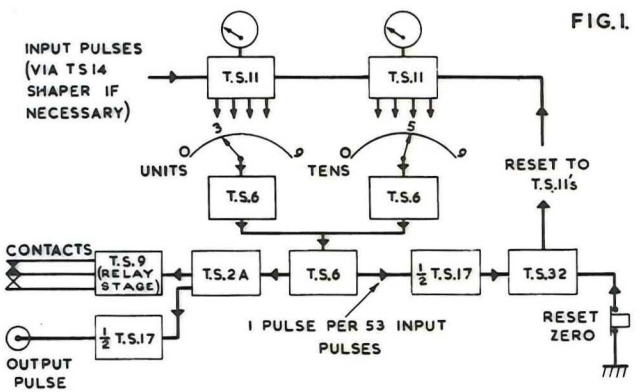
Base Connexions

	Pin No.	
Plug A	1	Base of VT6
	2	Meter +
	3	Supply Negative
	4	Base of VT4
	5	Reset 9
	6	Input
	7	Supply Positive (Earthy)
	8	Reset O

	Pin No.	
Plug B	1	Collector of VT1
	2	" VT2
	3	" VT3
	4	" VT4
	5	" VT5
	6	" VT6
	7	" VT7
	8	" VT8

read-out indicator of the Counting Instruments type, or to drive a printer. In order to do this a diode matrix, arranged for negative-going output is interposed between the TS11 and a series of Indicator output stages type TS34, the TS6 Gate Stages being dispensed with. The TS34 comprises two amplifier units in one housing, so that a total of five units is required per decade. The circuit arrangement is shown in Fig. 2.

FIG.1.



The output circuit of each ½/TS34 Amplifier is shown in Fig.3. Since the indicator lamp load is normally too great for the stabilized power supply used to operate the counting chain, an independent D.C. supply of up to 6 volts is employed for the external load circuit. Note that the current is limited to 300 mA per channel.

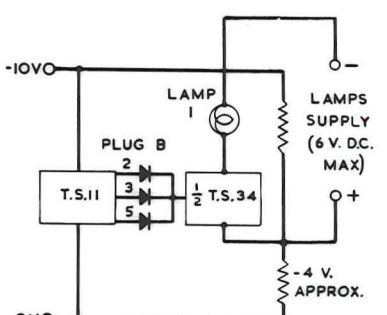


FIG.3. ½ T.S.34 OUTPUT CIRCUIT

4. BINARY CODED DECIMAL READ-OUT.

The circuit arrangement is shown in Fig. 4. Note that the 2nd, 4th, 6th and 8th collectors in the TS11 drive TS9 D.C. relay stages, the contacts of the latter being used to provide the binary output. The contact inter-connexions correct for true binary output on "8" and "9". Operation is direct on units 0 to 7 inclusive, but on outputs "8" and "9", the following would be obtained :-

Outputs	1	2	4	8
"8"	0	1	1	1
"9"	1	1	1	1

With the contact connexions shown outputs "2" and "4" are not obtained if the output "8" contacts are operated so that the correct outputs of 0001 and 1001 on "8" and "9" respectively are obtained.

SPECIFICATION.

Apart from the special base connexions, and the omission of the internal feedback capacitors, units TS11 and TS11/MF correspond to the standard Decade units types TS10 and TS10/MF. Reference should therefore be made to the Instruction Leaflet for TS10/10MF units for circuit, operating conditions, etc.

FINISH: Unit available mounted in removable plastic case or encapsulated.

CONNECTOR: The plugs mounted on the unit are intended for use with socket type XS8 made by the McMurdo Instrument Co.

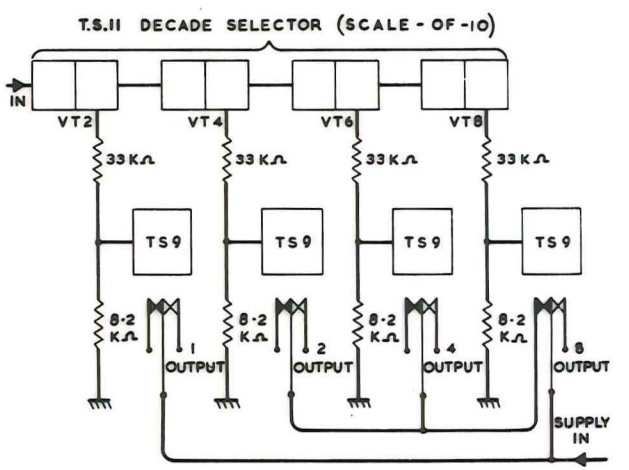


FIG. 4. BINARY CODED DECIMAL READOUT.

The operation will now be as per Instruction Leaflet for TS10 stages. The higher frequency unit type TS11/MF can be converted to a scale-of-ten in a similar manner except that a capacitor of 220 pF should be used in the first position with a capacitor of 120 pF in the second position.

2. USE AS A SELECTOR.

The additional plug B carries the output from the collectors of each binary stage, Pin 1 being connected to the collector of the first transistor, Pin 2 to the collector of the second transistor, and so on. In order to use the stage as a selector, therefore, each collector pin should be taken via a diode to a ten position switch with positions numbered 0-9. The switch wiper is connected to a selector gate, type TS6, from which an output pulse is obtained. The external wiring arrangement is shown in Fig. 5. With the diodes connected as shown, positive-going pulses are obtained from the TS11.

The operation of the circuit is such that if one Decade was used and the switch be set to Position 3, then an output pulse wouldbe obtained from the Selector Gate when three input pulses had been fed to the Selector although the standard output pulse would be obtained after ten input pulses had been received. In this way, if two Decade Selector stages were cascaded a carry pulse would be produced as with the Decade Counter TS10. If a second switch was employed and a second Selector Gate, then an output pulse would be received from the first after, say, the third input pulse (if the switch were set to 3) but a carry pulse would be fed every ten pulses. Thus, if the second switch were set to, say, 5 then an output pulse would only be obtained from the second Selector Gate after 50 pulses had been fed in. If the outputs from both Selector Gates were combined in a third Selector Gate, then a single pulse would be obtained after 53 pulses. Several stages may be cascaded and switches may thus be set to any desired number. The system is illustrated in Fig. 1 which is a basic circuit for a simple Batching Counter for alternate batching. Since the TS11 stages are reset to zero immediately upon receipt of an output pulse from the third Selector Gate, then the principle can also be employed for frequency division by almost any desired ratio. Fig. 1 in fact depicts a scale of 53 divider.

3. OPERATION OF OPTICAL IN-LINE READOUT.

The TS11 units are used when it is desired to obtain a 10-line output from each decade in order to operate the lamps in an in-line

Transistor DECADE SELECTOR UNIT Types TS11 TS11/MF

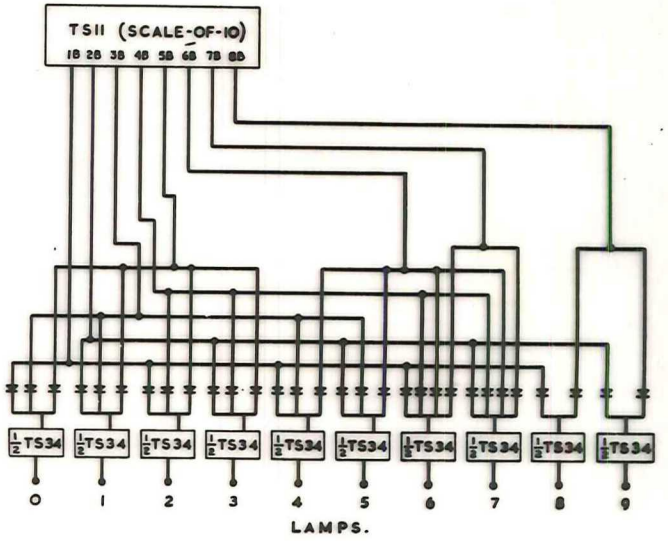


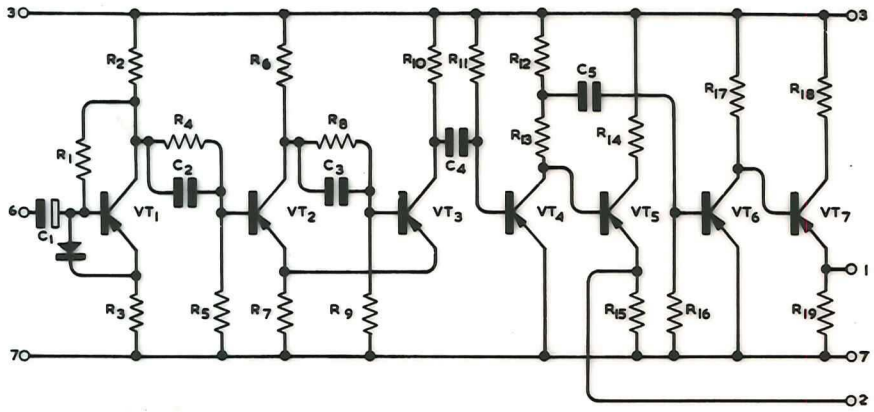
FIG. 2. TS11 WITH DIODE MATRIX FOR 10 LINE OUTPUT WITH INDICATOR OUTPUT STAGES.

IMPORTANT NOTE.

NON-ENCAPSULATED STAGES.

When attempting to remove the cover, it should be noted that the XP8 termination plug is secured to the base by four screws which should not be removed as they do not secure the cover to the base. If a stage becomes faulty, it should be returned to Venner Electronics Limited for rectification.

CIRCUIT DIAGRAM



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VENNER ELECTRONICS LIMITED
INSTRUCTION LEAFLET

Transistorized PULSE SHAPER Type TS14

The pulse shaper type TS14 has been designed to produce an output pulse suitable for feeding binary or decade units, up to a frequency of 100 kc/s, from a wide variety of input waveforms.

The circuit consists basically of a Schmitt trigger stage which is triggered from the amplified input. The output of the trigger stage is differentiated and shaped to provide two antiphase outputs.

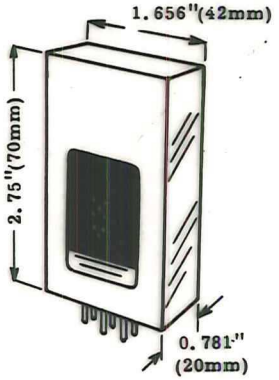
The TS14 is suitable for use at frequencies up to 120 kc/s. For higher frequency operation (up to 1 Mc/s) Pulse Shaper type TS27 is recommended.

IMPORTANT NOTE.

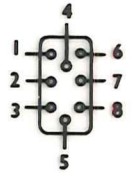
NON-ENCAPSULATED STAGES.

When attempting to remove the cover, it should be noted that the XP8 termination plug is secured to the base by four screws which should not be removed as they do not secure the cover to the base. If a stage becomes faulty it should be returned to Venner Electronics Limited for rectification.

Transistorized PULSE SHAPER
Type **TS 14**



Weight: 2 ozs. (57 gm).



Base Diagram (McMurdo XP8 plug)

Pin No.
1. Positive Output Pulse
2. Negative Output Pulse
3. Supply Negative.
4. No connexion.
5. No connexion.
6. Signal Input.
7. Supply Positive (earthy).
8. No connexion.

APPLICATION NOTES.

(1) The unit is designed to produce a steep-fronted narrow width pulse suitable for feeding units such as TS2, TS10/5, TS11 and TS10/5MF from pulse, sine or squarewave inputs having amplitudes between 0.75V - 15V peak. Within these limits no adjustment is necessary and the input waveform is not at all critical, so long as it does not pass through zero more than twice during one cycle. The output is produced by the negative-going edge of the input waveform.

(2) Waveforms with amplitudes greater than 10V peak should be attenuated to a suitable level before being applied to the unit.

(3) Two antiphase outputs are available, viz. a positive-going pulse at Pin 1 suitable for feeding directly to a binary or decade unit, and a negative-going pulse at Pin 2 intended for use with the Universal Gate type TS16, since the latter inverts the input pulse before applying it to the decade or binary unit.
Both outputs are taken via emitter followers, thus giving a relatively low output impedance.

(4) Due to the constancy of width and amplitude of the output pulse with variation of the input, this unit can also be used as a drive source for a diode pump integrator.

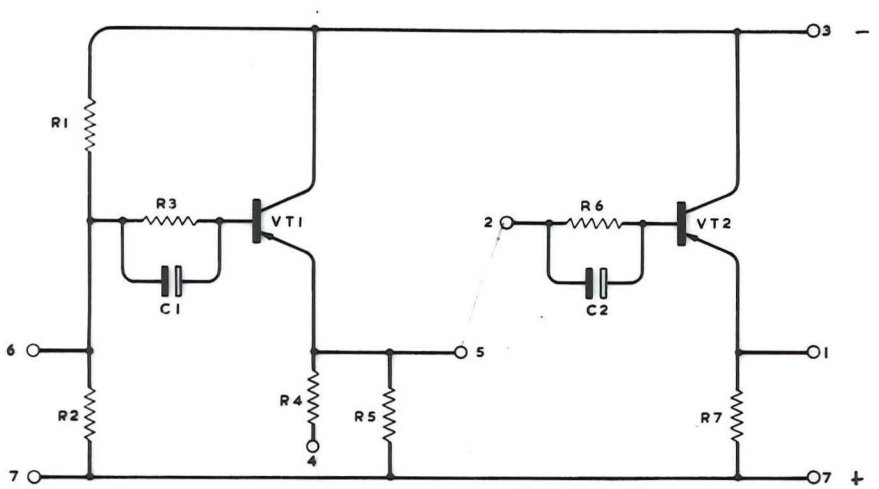
Transistorized PULSE SHAPER Type TS14

SPECIFICATION

FREQUENCY RANGE:	15 c/s to 120 kc/s - sine waveforms Random to 120 k. p. p. s - pulse
SUPPLY:	10V nominal. The unit functions satisfactorily from 6V to 12V.
INPUT:	0.75V to 15V peak. Waveform not critical(pulse). Sine waveform may be extended below 15 c/s by increasing the amplitude of the input signal.
OUTPUT: Pin 1 Positive pulse) Pin 2 Negative pulse)	Width: 2 µS at 20°C (increases with temperature to approximately 3.5 µS at 50°C. Rise Time: approximately 0.5 µS. Amplitude: approximately 0.7 x supply voltage, i.e. 7V with 10V supply.
TEMPERATURE RANGE:	-10°C to +50°C.
IMPEDANCES:	Input: 3 KΩ approximately. Output: 500Ω approximately.
CONSUMPTION:	250 mW at 10V.
FINISH:	Unit mounted in removable plastic case.
CONNECTOR:	The plug mounted on the unit is intended for use with socket type XS8 made by the McMurdo Instrument Company.

CIRCUIT DIAGRAM

VENNER ELECTRONICS LIMITED
INSTRUCTION LEAFLET



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Transistorized TWIN EMITTER FOLLOWER UNIT Type TS17

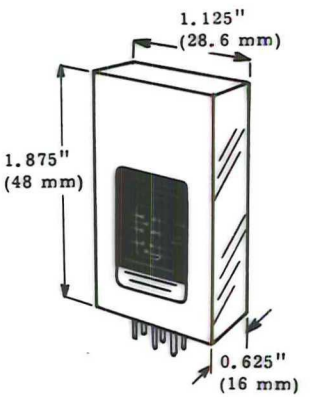
This unit contains two emitter followers which may be used independently of one another. Provision is also made to allow the two stages to be cascaded, thus enabling input impedance up to about 1 MΩ to be obtained. The TS17 is used as an impedance convertor or 'buffer' stage.

APPLICATION NOTES.

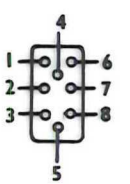
1) Input/Output Inter-dependence.

The transistor emitter follower differs from the valve cathode follower inasmuch as the input and output impedances are dependent upon each other. The output impedance of a cathode follower can be defined as approximately equal to $\frac{1}{gm}$ when gm is the mutual conductance of the valve. The input impedance is high and is not affected to any great extent by the loading on the output. However, the input impedance of an emitter follower is wholly dependent upon the load impedance, and the output impedance dependent upon the source impedance. In fact, the input impedance is approximately equal to α times the load impedance. This means that if the stage is used to drive another transistor the loading effect of the transistor would be reflected in the input. However, if one emitter follower is used to drive another, the resultant input impedance will be very high, largely independent of the output loading. In fact, the input impedance will be approximately 1500 times the output load, and even when the stage is used to drive a 25Ω load the input impedance will still be approximately 40KΩ

Transistorized
TWIN EMITTER FOLLOWER
Type **TS 17**



Weight: ¾ oz. (21 gm)



Base Diagram (McMurdo XP8 Plug)

Pin No.

1. Output (Stage 2)
2. Input (Stage 2)
3. Supply Negative
4. Join to Pin 7 when using stage 1 independently
5. Output (Stage 1) Join to Pin 2 to cascade stages
6. Input (stage 1)
7. Supply Positive (Earthy)
8. Unused.

2) D. C. Coupling.

Since the range of Venner transistorized stages are provided with d. c. coupled output connexions, the individual stages of this emitter follower are designed for d. c. coupling to the preceding unit. In this way the d. c. level at the output of the emitter follower is the same as that of the stage to which it is coupled. If a single stage, i. e. one half TS17, is to be used with an a. c. coupled input then a suitable biasing resistor must be connected to the negative supply line (see specification). With cascaded stages no such resistor is necessary.

Internal resistors, connected between the input pin of the first unit and the supply lines provide suitable bias for a. c. coupling to the input (cascaded stages). These resistors shunt the input impedance of the unit with approximately 2 MΩ which is sufficiently high to be ignored under most conditions.

3) Temperature Effects.

Owing to the high values of resistor used for the a. c. biasing of the cascaded stages the ambient temperature has a marked effect on the d. c. output level of the second stage. With the values used, the initial d. c. level at 20°C is approximately -3V. At 50°C this rises to approximately -9V with a 12V supply. Thus, under these conditions the cascaded stages are not suitable for driving into a d. c. coupled stage if a wide ambient temperature range is to be expected.

This change in output level is dependent on the biasing resistances, the lower the resistance the less the change in the output d. c. level. If it is required to operate the stage over a wide temperature range with little change of output level, then the input should be biased with suitable resistors. The actual values will depend on the degree of stabilisation required and the amount of loading that can be placed on the signal source. As a rough guide, an effective biasing impedance of 20 KΩ reduces the d. c. change to less than 1V.

4. A. C. Coupling.

When the cascaded stages are fed into an a. c. coupled stage the variation will not normally affect the operation. Also, when the stage is d. c. coupled to the preceding stage, the effective biasing resistance will be determined by the output circuit of the preceding stage. This will normally be sufficiently low to give very good stabilisation.

The effect of temperature change on a single stage emitter follower is sufficiently small to be ignored.

Transistorized TWIN EMITTER FOLLOWER UNIT Type TS17

SPECIFICATION.

	Single Stage.	Cascaded Stages.
Approx. input impedance:	60 x load impedance.	1500 x load impedance.
Approx. output impedance:	1/60 x source impedance.	1/1500 x source impedance.
Max. input impedance:	120 KΩ (approx)	900 KΩ (approx).
External bias resistor for mid-point biasing: (connected between pins 6 and 3 for first stage and pins 2 and 3 for second)	120KΩ each nett	Not required (internally fitted)
Max. signal handling capacity:	9/10 of supply (peak-to-peak).	
Temperature range:	-10°C to +50°C.	
Supply:	**-10V nominal (unit will function from -6V to -12V).**	
Consumption:	Dependent on signal source. 3 mA per stage max. with 10V supply.	
Max. dissipation:	30 mW per stage.	
Finish:	Unit mounted in removable plastic case.	
Connector:	The plug mounted on the unit is intended for use with socket type XS8 made by the McMurdo Instrument Co.	

IMPORTANT NOTE.

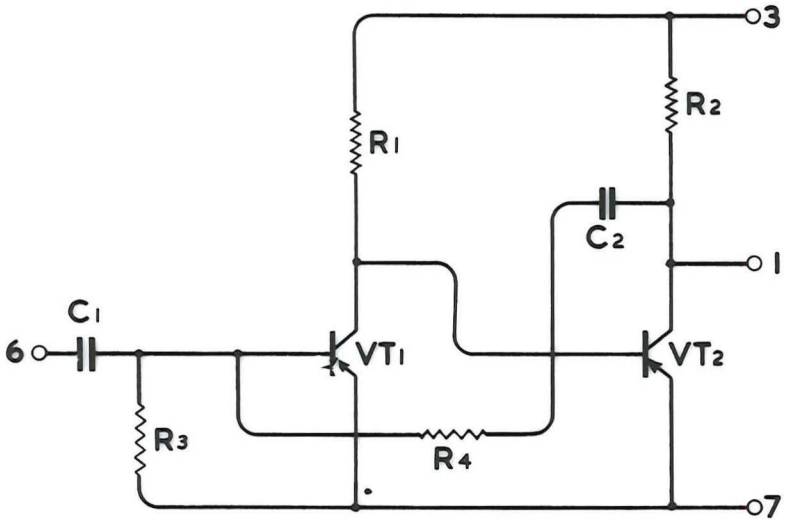
NON-ENCAPSULATED STAGES.

When attempting to remove the cover, it should be noted that the XP8 termination plug is secured to the base by four screws which should not be removed as they do not secure the cover to the base. If a stage becomes faulty, it should be returned to Venner Electronics Limited for rectification.

CIRCUIT DIAGRAM

VENNER ELECTRONICS LIMITED
INSTRUCTION LEAFLET

Transistorized
ELECTRONIC RESET UNIT
Type **TS 32**



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TS32/6011

Transistorized ELECTRONIC RESET UNIT Type TS32

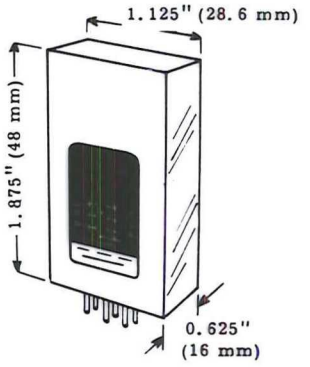
The current TS32 unit replaces the former TS32 and TS32/HF Electronic Reset Units.

The TS32 has been designed to enable binary and decade counter units to reset electronically, thus eliminating the use of contacts in the reset line. This ensures correct reset operation of binary and decade units, since the possibility of spurious reset operation due to contact bounce has been eliminated.

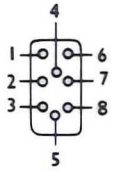
The application of a pulse waveform to the input pin 6 of the TS32, will cause the DC potential at the output pin 1 to rise momentarily towards the H. T. negative level. This raises the potential on the reset line connected from pin 1 of the TS32 to the reset pins of the binary and decade units.

Input: The TS32 will function correctly with an input pulse or DC change of amplitude greater than 0.5V. The rise time to the 0.5V point should be less than 0.25 mSec. If a pulse input is used the pulse width should be greater than the reset time of the units being reset.

Output: The reset line being controlled by the TS32 should be connected directly to the output pin 1. One TS32 unit will reset up to 42 binary units or the equivalent number of decade units. Should a greater number, up to 84 binary units or the equivalent number of decade units require to be reset, then a 1 KΩ resistor should be connected between pins 3 and 1 of the TS32 unit.
(1 decade = 4 binary units)



Weight: $\frac{3}{4}$ oz (21.5 gm)



Base Diagram (McMurdo XP8 Plug)

Pin
1. Output.
2. Not used.
3. Supply negative.
4. Not used.
5. Not used.
6. Input.
7. Supply positive (earthy).
8. Not used.

APPLICATION NOTES

(1) The TS32 unit will operate from the leading edge of a negative-going pulse or the trailing edge of a positive-going pulse; the latter having a minimum pulse width of 2 mSec.

(2) 42 binary units or an equivalent number of decade units may be reset by one TS32 unit. A greater number, up to 84, will require a 1 KΩ resistor connected across pins 3 and 1 of the TS32 unit.

(3) The reset operation of the TS32 unit may be achieved by the manual operation of a N/O push-button connected across a resistor at the negative end of a potential divider across the H. T. Supply. Pin 6 should be connected via a 47 KΩ resistor to the junction of the two resistors and one contact of the N/O push-button; the other contact being connected to the H. T. negative of the supply.

(4) A binary unit may be used to operate the TS32 unit via a 47 KΩ resistor connected to pin 6, with a resultant output pulse width of 1.5 mSec. approximately. If, however, a reset time comparable to the input pulse width is required, it is recommended that an emitter follower be connected between the two units.

IMPORTANT NOTE

Non-encapsulated stages: When attempting to remove the cover, it should be noted that the XP8 termination plug is secured to the base by four screws which should not be removed as they do not secure the cover to the base. If a stage becomes faulty, it should be returned to Venner Electronics Limited for rectification.

Transistorized ELECTRONIC RESET UNIT Type TS32

SPECIFICATION

SUPPLY VOLTAGE:	Nominally 10V. The TS32 will function satisfactorily from -6V to -12V.
INPUT:	Negative-going: Pulse or DC change greater than 0.5V. Rise time to 0.5V, less than 0.25 mSec. Minimum width, must be greater than the reset time of the unit being reset. Positive-going: Trailing edge of pulse, of amplitude greater than 0.5V. Fall time to 0.5V point, less than 0.25 mSec. Minimum width, greater than 2 mSec. Impedance: 15 KΩ Effect of source impedance: If the TS32 is fed from a low impedance source of sharp negative-going pulses of 2 µSec. to 1 mSec. duration, the output pulses will have approximately the same duration as the input signal. If fed from a high impedance source, the output pulse width will be 1.5 mSec. approximately.
OUTPUT: (Unloaded)	Momentary DC change from 0-10V (with 10V supply). Rise time: 0.25 µSec. approximately. Impedance: During reset 1 KΩ Loading: 42 binary units or equivalent in decades. (1 decade = 4 binary units).
TEMPERATURE RANGE:	-10°C to + 50°C
CONSUMPTION:	12 mA (10V supply).
FINISH:	Unit is mounted in removable plastic case.
CONNECTOR:	The plug mounted on the unit is intended for use with socket type XS8, made by McMurdo Instrument Company.