



EUROTHERM
DRIVES

Tension Control Unit Type 5525

Product Manual

© Copyright Eurotherm Drives Limited 2003

All rights strictly reserved. No part of this document may be stored in a retrieval system, or transmitted in any form or by any means to persons not employed by a Eurotherm group company without written permission from Eurotherm Drives Ltd.

Although every effort has been taken to ensure the accuracy of this document it may be necessary, without notice, to make amendments or correct omissions. Eurotherm Drives cannot accept responsibility for damage, injury, or expenses resulting therefrom.

WARRANTY

Eurotherm Drives warrants the goods against defects in design, materials and workmanship for the period of 12 months from the date of delivery on the terms detailed in Eurotherm Drives Standard Conditions of Sale IA058393C.

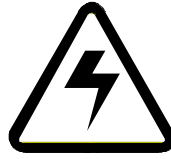
Eurotherm Drives reserves the right to change the content and product specification without notice.

© COPYRIGHT in this document is reserved to Eurotherm Drives Ltd.

INTENDED USERS

This manual is to be made available to all persons who are required to configure, install or service the equipment described herein or any other associated operation.

Warnings and Instructions



Warning

Only qualified personnel who thoroughly understand the operation of this equipment and any associated machinery should install, start-up or attempt maintenance of this equipment. Non-compliance with this warning may result in personal injury and/or equipment damage.

Never work on any control equipment without first isolating all power supplies from the equipment.

The drive motor must be connected to an appropriate safety earth. Failure to do so presents an electrical shock hazard.



Caution

This equipment was tested before it left our factory. However, before installation and start-up, inspect all equipment for transit damage, loose parts, packing materials etc.

This product conforms to IP20 protection. Due consideration should be given to environmental conditions of installation for safe and reliable operation.

THESE WARNINGS AND INSTRUCTIONS ARE INCLUDED TO ENABLE THE USER TO OBTAIN THE MAXIMUM EFFECTIVENESS AND TO ALERT THE USER TO SAFETY ISSUES

PRODUCT MANUAL: This manual is intended to provide a description of how the product works. It is **not** intended to describe the apparatus into which the product is installed.

This manual is to be made available to all persons who are required to design an application, install, service or come into direct contact with the product.

APPLICATIONS ADVICE: Applications advice and training is available from Eurotherm Drives Ltd.



INSTALLATION: Ensure that mechanically secure fixings are used as recommended.

Ensure that cables and wire terminations are as recommended and clamped to required torque.

Ensure that the installation and commissioning of this product are carried out by a competent person.



APPLICATION RISK: The integration of this product into other apparatus or systems is not the responsibility of Eurotherm Drives Ltd as to its applicability, effectiveness or safety of operation or of other apparatus or systems.

Where appropriate the user should consider some aspects of the following risk assessment.



RISK ASSESSMENT: Under fault conditions or conditions not intended.

1. The motor speed may be incorrect.
2. The motor speed may be excessive.
3. The direction of rotation may be incorrect.
4. The motor may be energised (unless the installation specifically prevents unexpected or unsequenced energisation of the motor).

In all situations the user should provide sufficient guarding to prevent risk of injury and/or additional redundant monitoring and safety systems.

NOTE: During power loss the product will not operate as specified.

MAINTENANCE: Maintenance and repair should only be performed by competent persons using only the recommended spares (or return to factory for repair). Use of unapproved parts may create a hazard and risk of injury.



WHEN REPLACING A PRODUCT IT IS ESSENTIAL THAT ALL USER DEFINED PARAMETERS THAT DEFINE THE PRODUCT'S OPERATION ARE CORRECTLY INSTALLED BEFORE RETURNING TO USE. FAILURE TO DO SO MAY CREATE A HAZARD AND RISK OF INJURY.

PACKAGING: The packaging is combustible and if disposed of in this manner incorrectly may lead to the generation of toxic fumes which are lethal.

REPAIRS: Repair reports can only be given if sufficient and accurate defect reporting is made by the user.

Remember, the product without the required precautions can represent an electrical hazard and risk of injury, and that rotating machinery is a mechanical hazard and risk of injury.

PROTECTIVE INSULATION:

1. All exposed metal insulation is protected by basic insulation and bonding to earth i.e. Class 1.
 2. NOTE: Earth bonding is the responsibility of the installer.
 3. All signal terminals are protected by double insulation, i.e. Class 2 insulation. The purpose of this protection is to allow safe connection to other low voltage equipment and is not designed to allow these terminals to be connected to any unisolated potential.
 4. Single fault conditions.
-

Contents

Chapter 1	General	
Chapter 2	Control System	
	Type 5525	2-3
	Tension Control Unit	2-3
	Standard Features	2-3
Chapter 3	Technical Details	
Chapter 4	Tension Control for use with Centre Winders to Provide Constant Tension/Taper Tension Control	
	Commissioning Procedure & Product Code	4-1
Chapter 5	Centre Winder Tension Characteristics	
	Scaling	5-3
	Build up ratio	5-3
Chapter 6	Circuit Diagrams	

Chapter 1 General

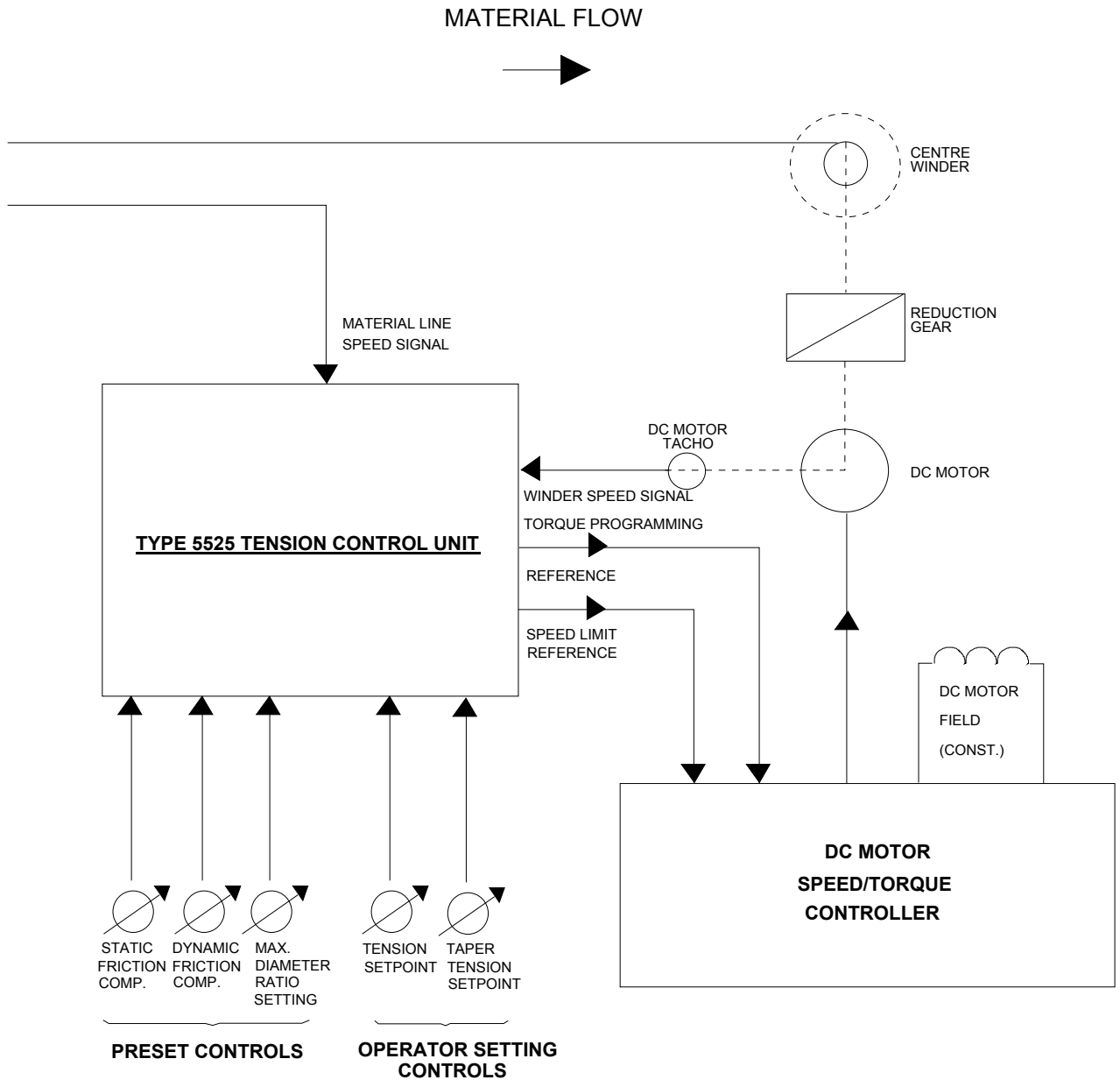
The Eurotherm Drives type 5525 Tension Control Unit is designed to provide accurate tension control of materials during winding by DC motor powered centre winders.

The Tension Controller would normally operate in conjunction with an Eurotherm Drives single phase or 3-phase thyristor motor controller, although operation with other motor controllers is possible providing that independent torque and speed control reference inputs are available.

The type 5525 unit is extremely flexible in operation and is applicable to winding systems in a variety of processing industries such as plastics, paper, film, wire, metal strip, etc. The compact size of the 96mm DIN package and the comprehensive integrated control circuitry with built-in power supplies, make the 5525 extremely easy to install and simple to set up.

Chapter 2 Control System

CENTRE WINDER WITH TYPE 5525 TENSION CONTROL SYSTEM



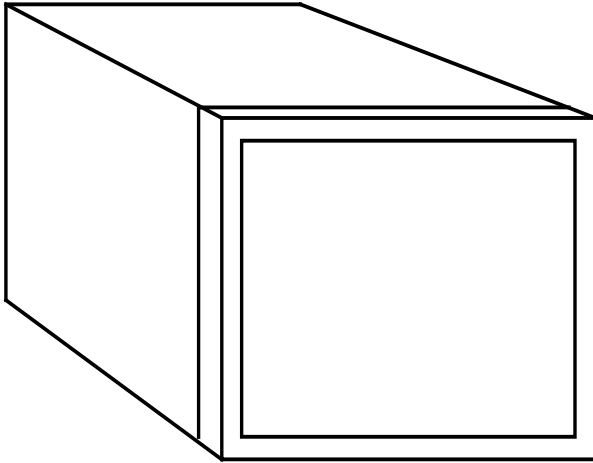
The 5525 Tension Controller operates by programming the torque applied by a DC motor to a centre wind drive system during reel build-up.

The tension of material passing onto the periphery of a centre winder depends upon the torque applied by the motor to the winder centre shaft and the instantaneous diameter of the reel. With constant torque applied, the material tension will decrease proportionally with reel diameter as the reel builds up. To maintain a constant tension in the wound material it is therefore necessary to increase the shaft torque proportionately as the reel diameter increases. It is possible to achieve constant control of tension throughout a winding cycle providing that the applied torque can be continuously regulated in proportion to the reel diameter.

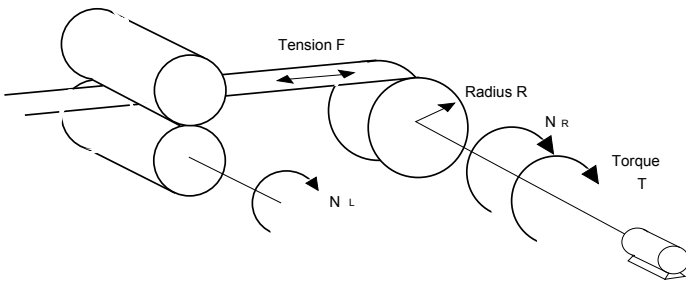
By continuously monitoring signals of material line speed and winder speed, the 5525 controller calculates reel diameter and provides a torque control reference to the motor controller. Accurate operation can be achieved over a wide range of material line speeds and build-up ratios.

Additional circuit facilities in the controller provide a continuously variable amount of taper tension, so that light tapers may be introduced to give only small deviation from constant tension from beginning to end of a wind; or alternatively severe tapers may be introduced to reduce the material tension to virtually zero at the end of a wind. It should be noted that the tension and taper controls are completely non-interactive.

It should be noted that this unit is not capable of controlling tension at zero speed. If this facility is required, stall tension or diameter memory methods should be incorporated into the system.

TYPE 5525**Tension Control Unit****Standard Features**

- * Static friction compensation.
- * Dynamic friction compensation.
- * Taper tension (tension either increasing or decreasing as reel diameter increases).
- * Minimum diameter offset.



The 5525 Tension Control Unit is designed to provide tension control of material wound onto DC motor operated centre winders.

Continuous calculation of reel diameter enables the unit to programme the torque reference of a DC motor controller to provide any tension/diameter winding profile.

Reel torque $T = \text{Tension } F \times \text{Radius } R$

Radius R is proportional to $\frac{(\text{Line Speed}) N_L}{(\text{Reel Speed}) N_R}$

giving T is proportional to $F \times \frac{N_L}{N_R}$

But T is proportional to the armature current I_A in a DC motor with constant field,

hence I_A is proportional to $F \times \frac{N_L}{N_R}$

Chapter 3 Technical Details

Supply	- 1 phase, 110/115V, 50/60Hz 220/240V, 50/60Hz
Line Speed Input	- +10V DC Internal scaling is necessary for non-standard input voltages. (see scaling section).
Winder Speed Input	- +10V DC Internal scaling is necessary for non-standard input voltages (see scaling section).
Output Torque Control Signal	- 0 to +10 Volts DC or 0 to -10 Volts DC
Max/Min. Diameter ratio	- Up to 20 to 1.
Maximum ambient temperature	- 50°C.
Control by	- Diameter Computation. Diameter ratio ranges: between 1 and 5:1 between 5 and 10:1 between 10 and 20:1
Control Modes	- Constant Tension. - Taper Tension.
External Connection for setting controls	- Tension setting potentiometers. - Taper tension setting potentiometer. - Manual speed limit potentiometer.
External connections for pre set controls	- Static friction compensation. - Dynamic friction compensation. - Minimum diameter offset.
Mechanical	- Panel mounting 96mm x 96mm DIN standard. Overall length 165mm. Panel cut out 92 x 92mm +.8mm -.0mm.
Options	- Plug-in sleeve. Tension control operator station with all setting controls.

Chapter 4 Tension Control for use with Centre Winders to Provide Constant Tension/Taper Tension Control

COMMISSIONING PROCEDURE & PRODUCT CODE

The basic DC drive must be operating correctly, i.e., motor rotation, speed and current scaling, before the tension control system can be commissioned. The basic drive commissioning procedure is detailed in the relevant drive manual.

1. Check the tension control unit specification label that all details are correct, i.e.,
Supply voltage
Line speed reference volts
Winder Speed reference volts.
Build up ratio coded as follows
(5525/--/--/xxx/--

xxx = 101 Ratio between 1 and 5: 1
xxx = 102 Ratio between 5 and 10: 1
xxx = 103 Ratio between 10 and 20: 1

1.1 Product Code

Field Block 1

4 digits specifying basic product.

5525 Tension Control Unit

Field Block 2

Output Type	01	Positive going
	02	Negative going

Field Block 3

Power Supply	10	110V
	11	115V
	12	220V
	13	240V

Field Block 4

3 digits specifying build up range.

101	Build up ratio 1:1 to 5:1
102	Build up ratio 5:1 to 10:1
103	Build up ratio 10:1 to 20:1

Field Block 5

Options	00	Standard unit
	01	Plug-in unit

2. Thoroughly check out all external wiring.
 - Power connections
 - Line and winder tachogenerator connections.
 - Drive connections.
 - Preset and operator control connections.

The wiring should be checked against the system connection diagram supplied with the tension control system.

3. Connect the supply to the tension control unit and check the following voltages.
Terminal 32 with regard to 30 Supply volts 110/240V AC.
Terminal 17 with regard to 18 + 10V DC.
Terminal 2 with regard to 18 - 10V DC.

The following tests should be carried out without any web on the line or winder.

-
4. Start the line drive and check the voltage on terminal 21 with regard to 18 is approximately +10V DC at full winder speed (it may be necessary to turn up the tension setting potentiometer while running the line at full speed to achieve full winder speed). If either signal is of the opposite polarity the relevant tachogenerator connection must be reversed. If the signal is of the wrong value the tachogenerator voltage should be checked if too high rescale tension controller (see scaling section).
 5. Set the taper potentiometer and the friction compensation presets to zero. With the line running at full speed adjust the winder speed, with the tension control or speed limit control if provided, to give equal peripheral speed on the line and the winder core.

Monitor terminal 31 with regard to 18 and adjust the minimum diameter offset potentiometer for zero volts.

If it is impossible to match line and winder peripheral speed, the minimum diameter offset potentiometer should be preset as follows:

Code

1012V on terminal 27 with regard to 18

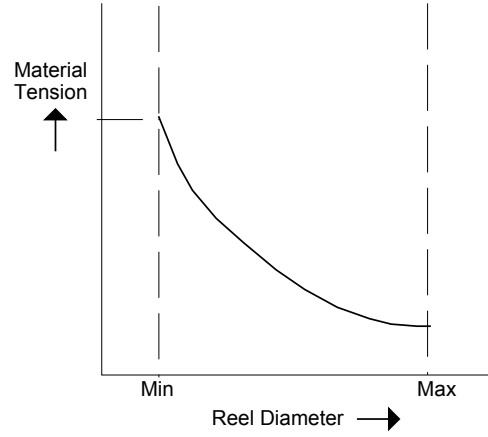
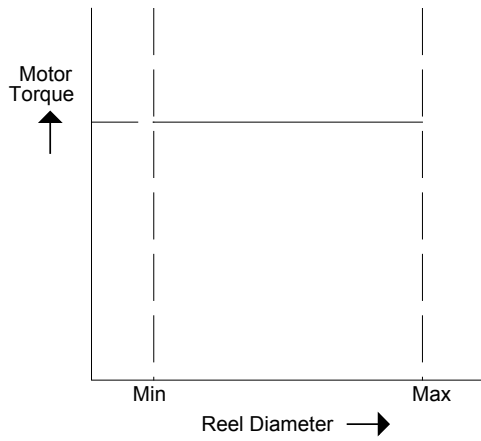
1021V on terminal 27 with regard to 18

1030.5V on terminal 27 with regard to 18

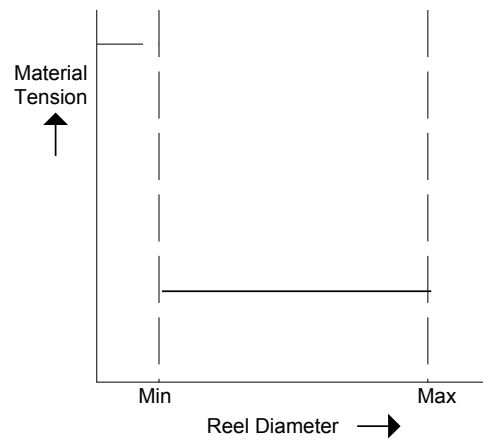
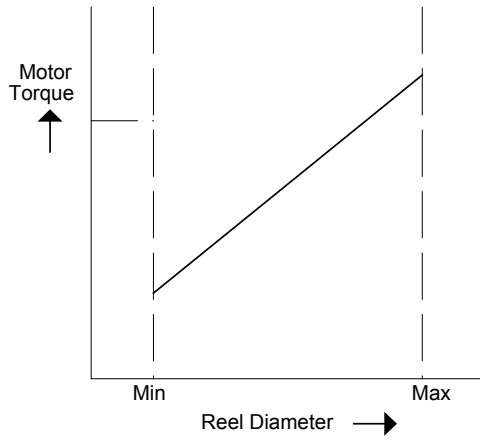
6. With the line running at full speed monitor terminal 20 with regard to 18 and check that the voltage increases as the winder speed decreases in proportion to the simulated diameter build up. If the taper control is set to maximum the voltage will remain constant equivalent to minimum diameter irrespective of winder speed.
7. Frictional losses compensation. With the line and winder running, set the tension control to zero. when the winder is at rest, slowly turn up the static compensation preset until the winder just rotates. This compensates for the static friction or stiction. Turn the dynamic friction preset fully up. Turn up the set tension control until the winder is running at more than half speed then turn back fully. Slowly turn down the dynamic friction preset until the speed starts to fall, adjust so that the speed very slowly runs down. This compensates for the dynamic friction or rolling resistance.
NOTE: It may be necessary to re-adjust these settings from time to time as mechanical conditions change.
8. Ensure that the surface speed of an empty core on the rewind exceeds the line speed by about 10% across the speed range of the line.
9. Thread web on to the line and winder and run the complete line setting tension and taper controls for optimum winding.

Chapter 5 Centre Winder Tension Characteristics

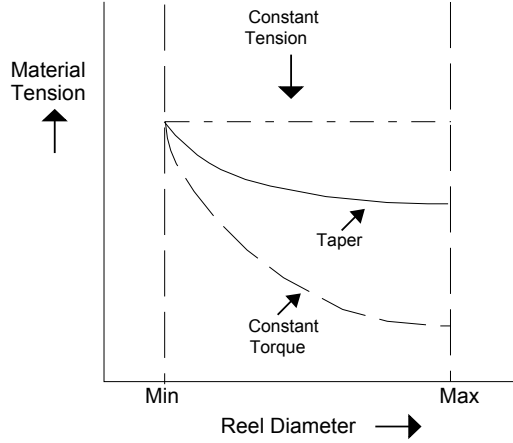
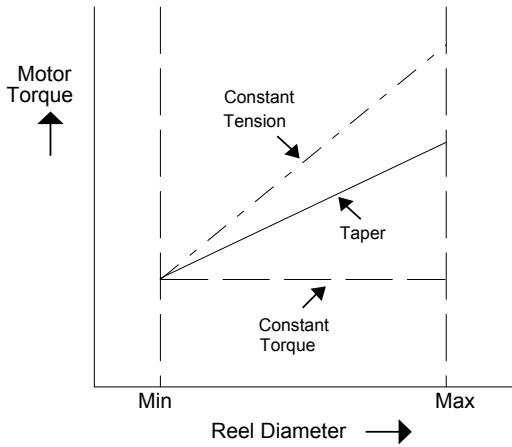
1. Constant Torque



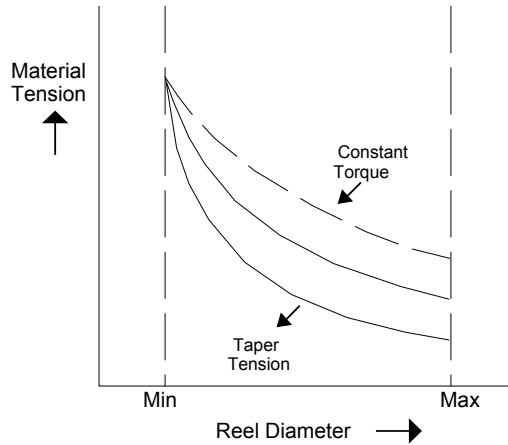
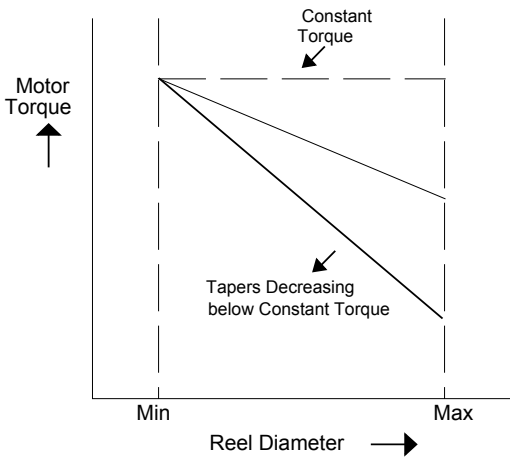
2. Constant Tension



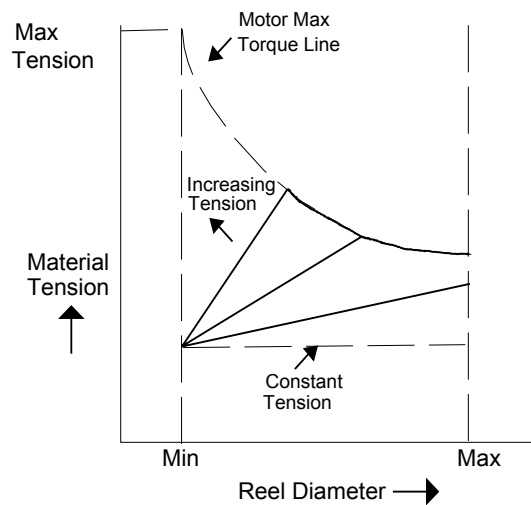
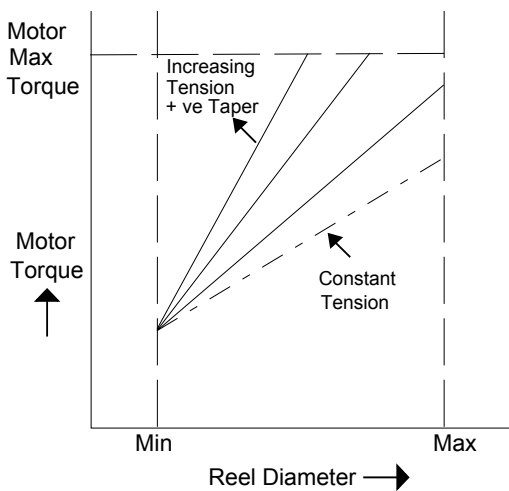
3. Taper Tension (-)ve - (Constant Tension to Constant Torque).



4. Taper Tension (-)ve - (Below Constant Torque Characteristic).



5. Taper Tension (+)ve - Tension Increasing.



Scaling

If the line or winder tachogenerator signals are not as specified on the 5525 tension control unit, it will be necessary to rescale as follows:

Remove the unit lid and unplug the tension printed circuit card (see diagram).

Line volts: scaling resistors R1 and R2, select R1 + R2 in kilohms is equal to the value in volts of the line tachogenerator at full speed.

Winder volts: scaling resistors R4 and R5, select R4 and R5 in kilohms is equal to the value in volts of the winder tachogenerator at full speed.

Fine adjustment of the scaling is possible using potentiometer P1 for line volts and P2 for winder volts but this is not essential.

Build up ratio

If the maximum diameter build up ratio exceeds the coded specification, resistor R13 will have to be changed.

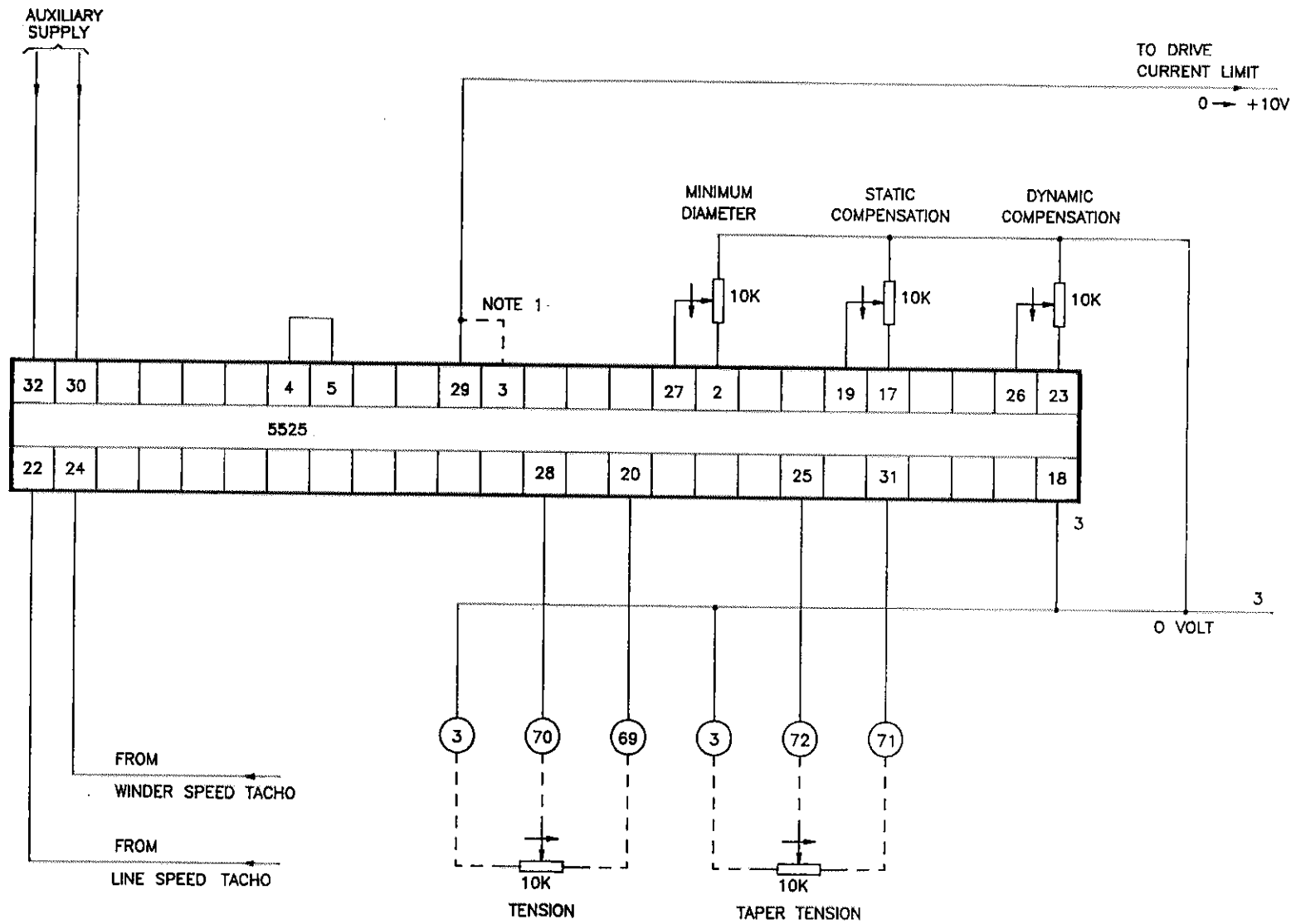
Ratio between 1 and 5 : 1 R13 = 3K9

Ratio between 5 and 10 : 1 R13 = 9K1

Ratio between 10 and 20 : 1 R13 = 18K

Note: Since R13 and R14 provide an attenuation network to allow for build up ratio, it is the relative values of these two resistors which is important. There is therefore an alternative set of resistor values which provide the same performance as those detailed above.

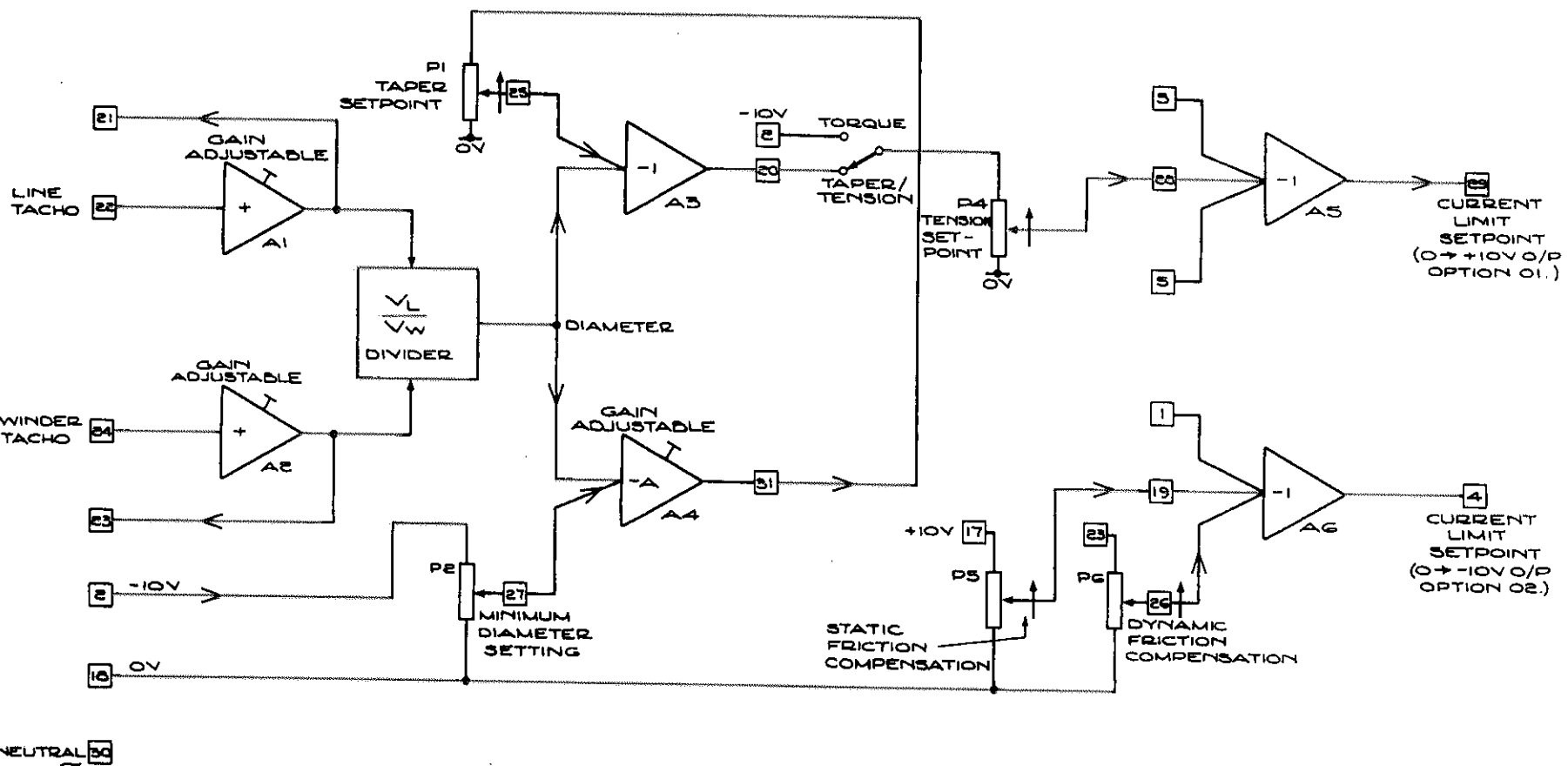
Build Up	R13	R14
5 : 1	9K1	2K2
10 : 1	9K1	1K
20 : 1	9K1	470R



NOTE 1
LINK 29 TO 3 TO GIVE 0 TO +5V CURRENT LIMIT

© 1990 SSD LTD.

DRAWN GDR	CHECKED JL	DATE 18-03-90	ELECTRICAL SYMBOLS GENERALLY TO BS 3939	TITLE CONNECTION DIAGRAM FOR 5525 TENSION CONTROL SYSTEM	USED ON
TRACED SH	DESIGN APP.	SSD A	LITTLEHAMPTON ENGLAND TELEX 87142	SSD	DRAWING NUMBER HB 357172 D
					SHT. 1 OF 1



NOTE 1. ALL POTENTIOMETERS AND SWITCHES MUST BE MOUNTED EXTERNALLY AND WIRED TO THE TERMINALS MARKED 1-32 ON THE REAR OF THE TENSION UNIT.

NOTE 2. FOR OPTION 01 (0 to +10V O/P.) LINK TERMINALS 4 & 5 EXTERNALLY, O/P ON 29.
 FOR OPTION 02 (0 to -10V O/P.) LINK TERMINALS 29 & 1 EXTERNALLY, O/P ON 4.

DRAWN	C.E.F.
CHECKED	
DESIGN APPROVAL	
MANF. APPROVAL	

MATERIAL	
FINISH	

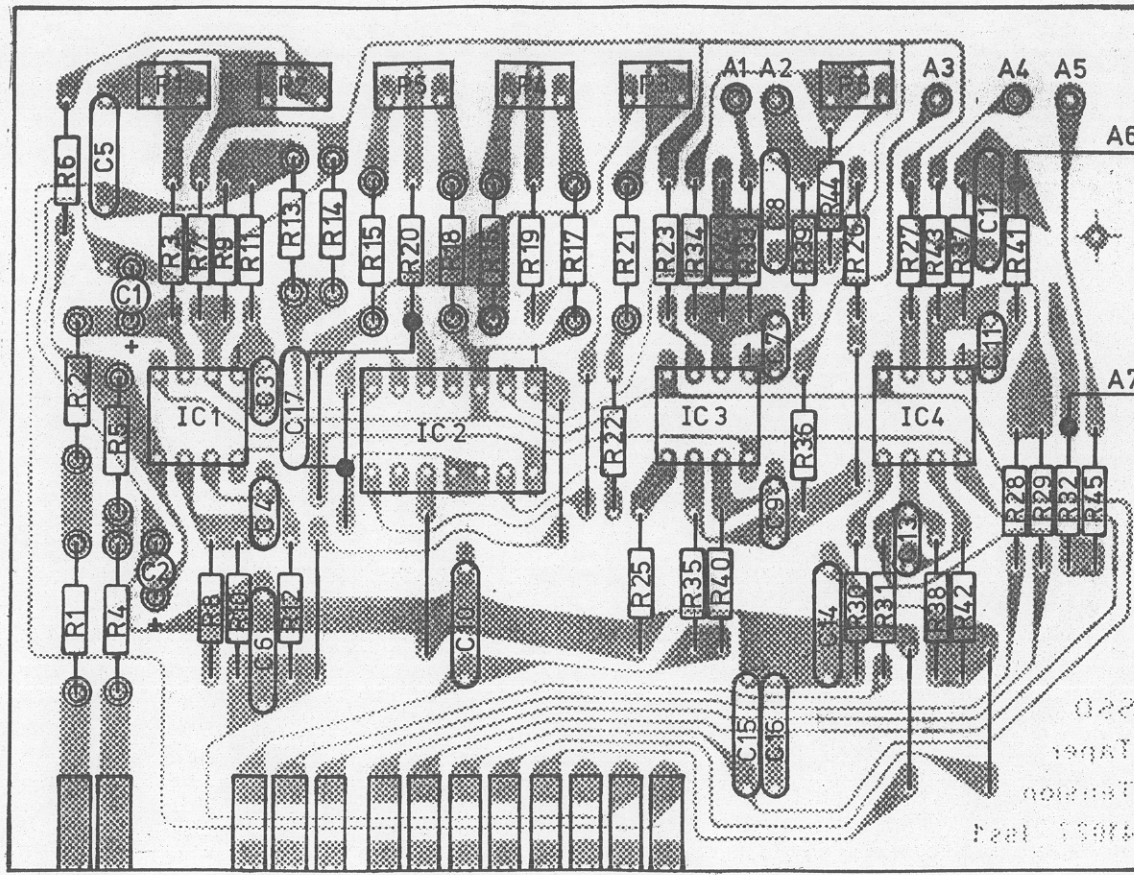
DIMS. IN M.M. APPLY OVER FINISH (EXCEPT FOR PAINT AND LACQUER)	
GENERAL	X = ±0.4
TOLERANCE	XX = ±0.2
	XXX = ±0.1
HOLES < #7mm -0.02 +0.07	

ASSEMBLED ON

SCALE	TITLE
	TENSION / TAPER SCHEMATIC
DRAWING NUMBER	SHT. 1
H1041046D	OF 1 SHTS

Drg. No.
AH041027 D001

THIRD ANGLE PROJECTION



A B C D E F G H J K L M N

+15V
-15V
0V
+10V

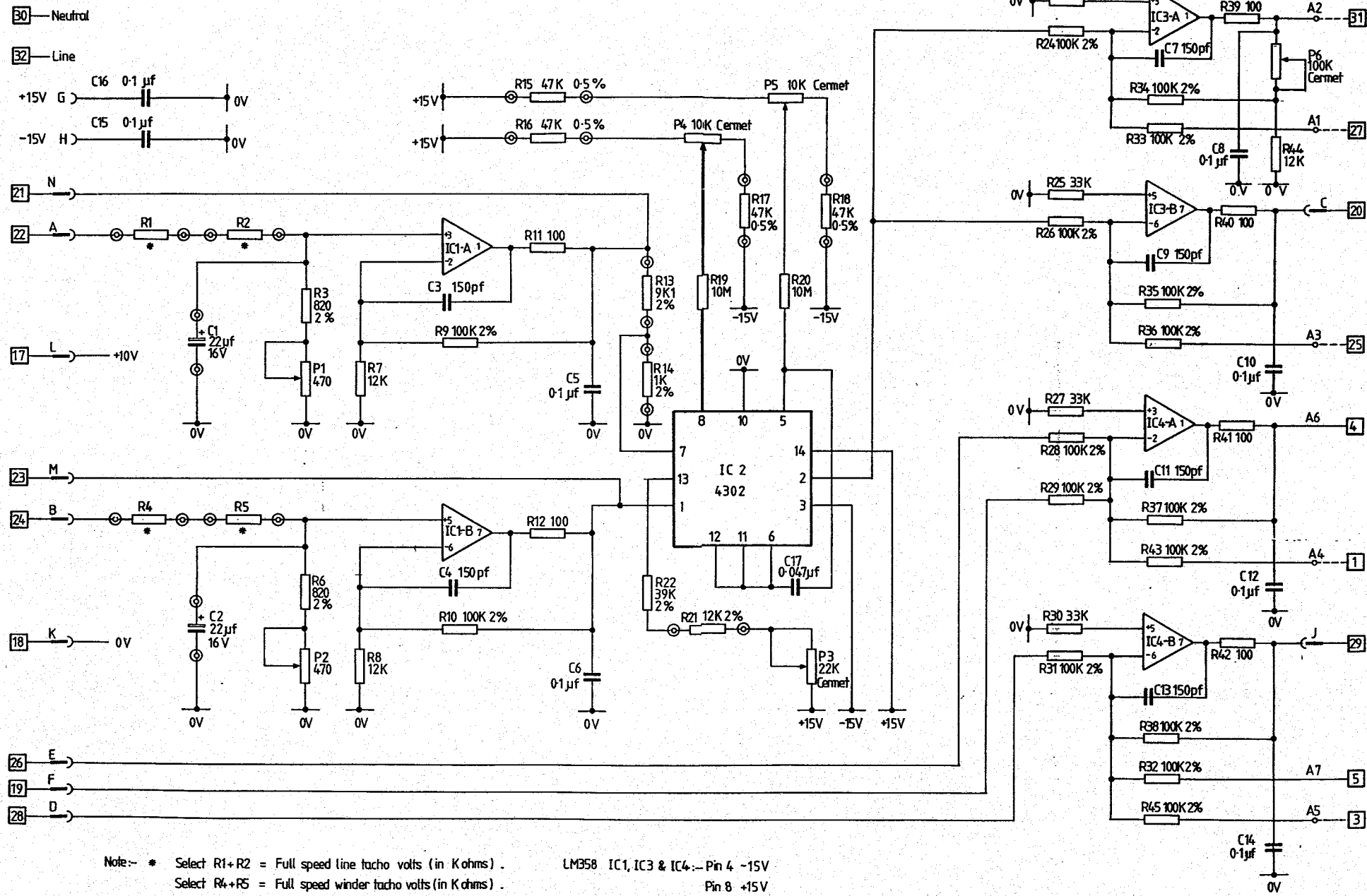
IMPORTANT

unless otherwise stated
all dimensions are mm
and apply over finish.

TOLERANCES

X	± .4	holes under
X·X	± .2	7 dia.
X·XX	± .1	+ .06 - .02

drawn <i>DWS</i>	issue A	mod	date 22.5.78	issue	mod	date	material	scale	Shackleton system drives	title PCB ASSEMBLY TAPER TENSION BOARD
checked	1	543	20.5.80				finish	used on		code Drg. No. AH 041027 D 001
design approval										
prod. approval										



DATE

9-6-80

DRAWN D.J.H.

CHECKED *W.S.*

DESIGN APPROVAL

MANF. APPROVAL

MATERIAL

FINISH

DIMS IN M.M. APPLY OVER FINISH
 (EXCEPT FOR PAINT AND LACQUER)

GENERAL X.X ± 0.41

TOLERANCE X.XX ± 0.52 HOLES < Ø7mm

X.XX ± 0.51 -0.02 + 0.07

ASSEMBLED ON

SSD Shackleton drives

SCALE

EI

TITLE

TENSION TAPER CIRCUIT DIAGRAM

DRAWING NUMBER

AI 041027 E 001

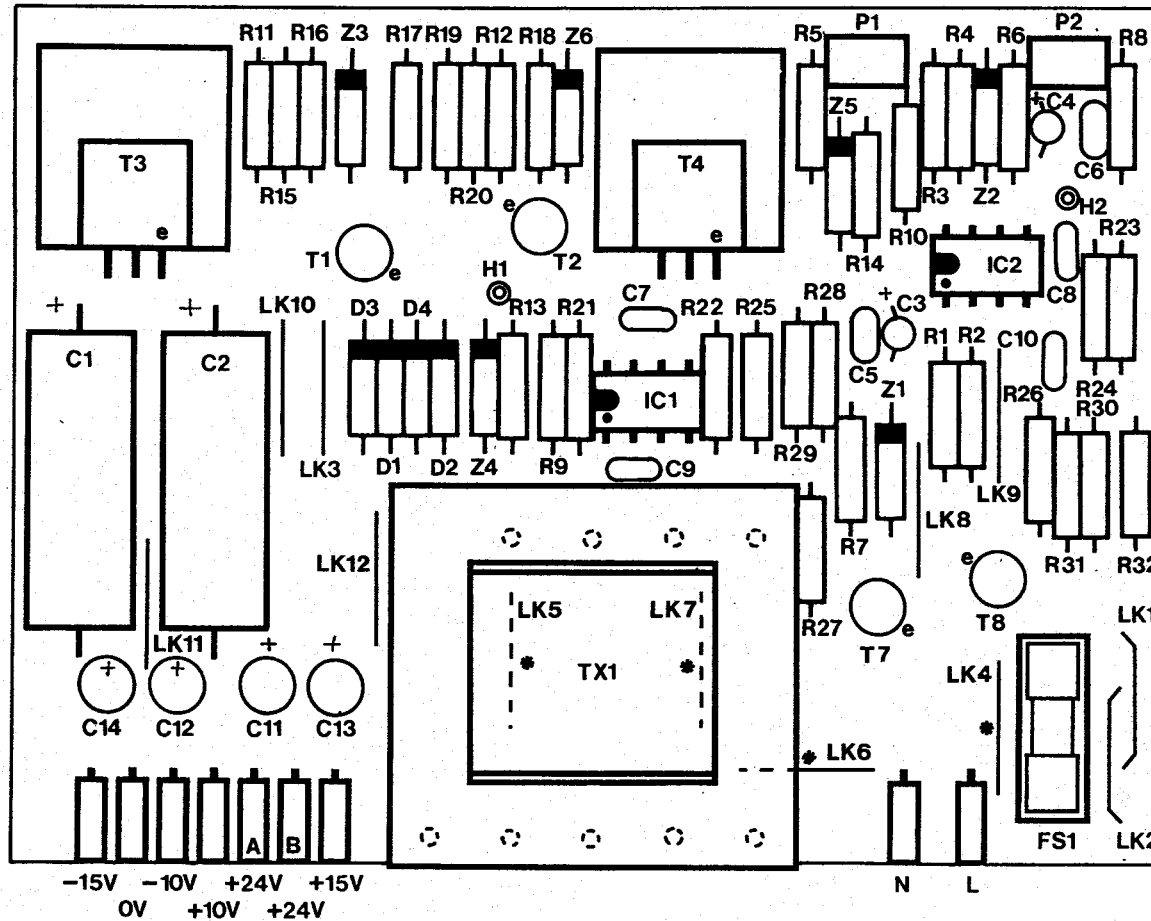
SHT. 1 OF 1 SHTS.

DO NOT SCALE

THIRD ANGLE PROJECTION

GENERAL DRAWING PRACTICE TO BS308/ BS 3939

1	DATE
1	3-3-80
2	14-12-89
3	26/7/90



*Denotes Option dependant Link - Fit only when TX1, FS1, LK1 & LK2 are omitted

DRAWN	<i>ME</i>
CHECKED	<i>ORV</i>
DESIGN APPROVAL	
MANF. APPROVAL	

MATERIAL	
FINISH	

DIMS IN M.M.APPLY OVER FINISH
(EXCEPT FOR PAINT AND LACQUER)

GENERAL TOLERANCE	X = ± 0.4	X.X = ± 0.2	HOLES < Ø7mm
	X.XX = ± 0.1		-0.02 + 0.07

ASSEMBLED ON

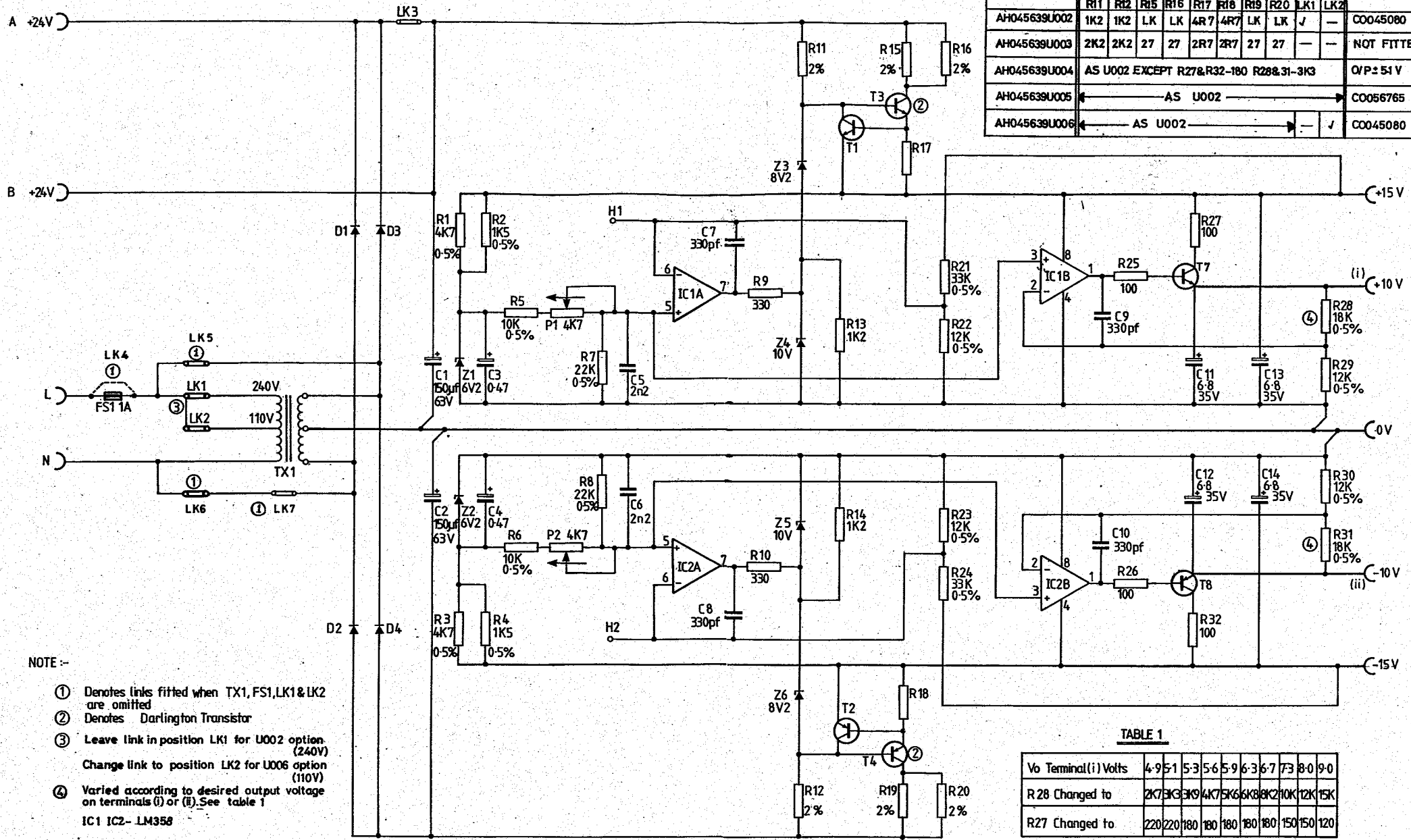
SSD Shackleton system drives

SCALE 2:1

EI

TITLE PCB ASSEMBLY AUXILIARY POWER SUPPLY	
DRAWING NUMBER AH045639D001	SHT. 1 OF 1 SHTS.

OPTION	RESISTOR VALUES											TRANSFORMER
	R11	R12	R15	R16	R17	R18	R19	R20	LK1	LK2		
AH045639U002	1K2	1K2	LK	LK	4R7	4R7	LK	LK	J	-	-	CO045080
AH045639U003	2K2	2K2	27	27	2R7	2R7	27	27	-	-	-	NOT FITTED
AH045639U004	AS U002 EXCEPT R27&R32-180 R28&31-3K3											O/P ± 51 V
AH045639U005	← AS U002 →											CO056765
AH045639U006	← AS U002 →											CO045080



NOTE :-

- ① Denotes links fitted when TX1, FS1, LK1 & LK2 are omitted
- ② Denotes Darlington Transistor
- ③ Leave link in position LK1 for U002 option (240V)
Change link to position LK2 for U006 option (110V)
- ④ Varied according to desired output voltage on terminals (i) or (ii). See table 1

IC1 IC2 - LM358

TABLE 1

Vo Terminal (i) Volts	4.9	5.1	5.3	5.6	5.9	6.3	6.7	7.3	8.0	9.0
R28 Changed to	2K7	3K3	3K9	4K7	5K6	6K8	8K2	10K	12K	15K
R27 Changed to	220	220	180	180	180	180	180	150	150	120

Same applies to terminal (ii) (-ve Voltage) change R31, R32

DATE	A	3/12/79	DRAWN DJH.	MATERIAL	DIMS IN M.M. APPLY OVER FINISH (EXCEPT FOR PAINT AND LACQUER)	ASSEMBLED ON	SCALE	TITLE AUXILIARY POWER SUPPLY BOARD P.C.B. CIRCUIT DIAGRAM	DRAWING NUMBER AI 045639 E 001	SHT. 1 OF 5HTS.
	B	2/1/80								
	C	3/1/80								
	D	12/1/80								
	E	19/5/80								
F	11/6/80	CHECKED E.T.P.	FINISH	GENERAL X.X = ± 0.4 TOLERANCE X.XX = ± 0.1 HOLES (Ø) min = -0.02 + 0.07	Shackleton system drives	E.I.				
G	20/7/81									
H	4/7/81									
I	14/7/89	DESIGN APPROVAL E.T.P.								
J		MANF. APPROVAL E.T.P.								

ISS.	MODIFICATION	ECN No.	DATE	DRAWN	CHK'D
1	Initial Issue				
2	Amendments and up-dating sales and service addresses.	2918	13.02.90	--	GDR
3	Re-typed manual in "Word". Changed SSD to Eurotherm Drives. Replaced AH045639D001 Issue 2 with Issue 3.	8287	28.11.94	FEP	

FIRST USED ON		MODIFICATION RECORD	
		5525 Product Manual	
 EUROTHERM DRIVES		DRAWING NUMBER	
		ZZ 043981 C	SHT OF

KE04300C ISSUE 3

IA058377 ISSUE 3 03.10.94

ARTWORKER 903985/A

SALES & SERVICE

EUROTHERM DRIVES, a division of Eurotherm International Group of Companies, provides sales and service capability worldwide through Eurotherm Drives Companies, Eurotherm Group Companies and Agents.

Head Office

Eurotherm Drives Limited
New Courtwick Lane
Littlehampton
West Sussex
BN17 7PD

Tel: (01903) 721311
Telex: 87142
Fax: (01903) 723938