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BALDOR[®]
MOTORS AND DRIVES

**BTS 10 R/RL SERIES
SERVO CONTROL
FOR BRUSHLESS AC MOTORS**

INSTALLATION & INSTRUCTION MANUAL

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Warning!

These instructions are for use by qualified personnel only.

In order to avoid electrical shock, do not perform any servicing other than that contained in the Operating and Service Manual unless you are qualified to do so.

Dangerous voltage exists on the screw terminals of power inlet and outlet when energized. Exercise extreme care when working on an energized circuit.

When a unit needs to be replaced, wait at least 2 minutes to allow a discharge of the power-capacitors and touch only the handle on the front-side. Use isolated tools for removal of connecting wires and avoid to touch the contacts.

CHANGE NOTICE

On reprint of this manual the following changes are included:

1. Instructions and information for BTS 10 RL (Low Power) added.
2. Page 1: Cont. Output Power corrected

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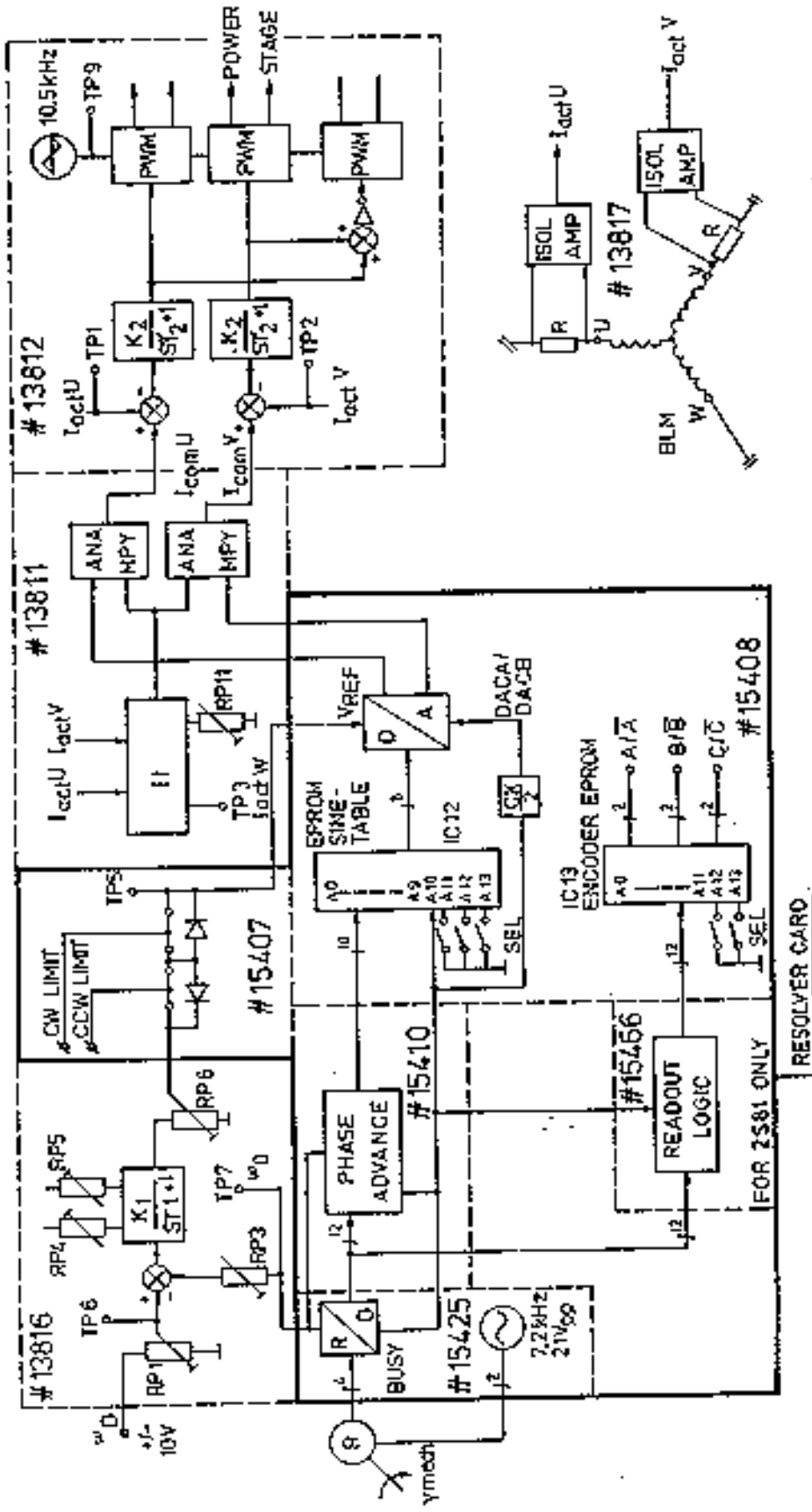
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BTS 10 R/RL - DRIVE SPECIFICATION SHEET

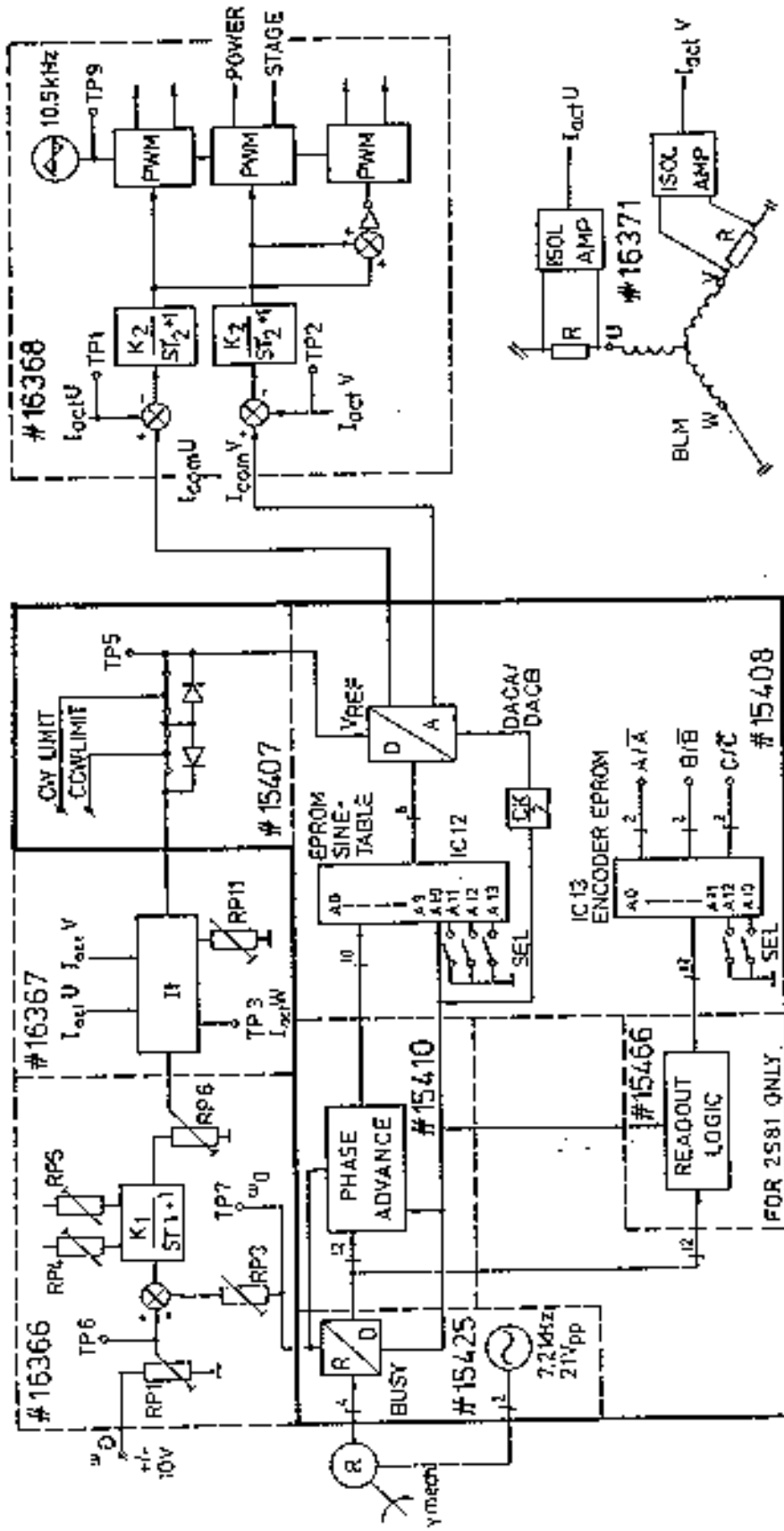
PARAMETER	Units						
	200-1 RL	200-2.5 R/RL	200-5 R/RL	200-10 R	200-15 R	200-22.5 R	
GENERAL							
Nom. DC Bus Voltage ¹	V DC	200.0					
Voltage Range	V DC	160 - 240					
Max. Output Voltage at nominal Bus (U _{LL})	V AC	153.0					
Cont. Phase Current	A(rms)	1.0	2.5	5.0	10.0	15.0	22.5
Max. Peak Current 2.5 s	A(rms)	2.0	5.0	10.0	20.0	30.0	45.0
Cont. Output Power	kVA	0.3	0.7	1.3	2.7	4.0	6.0
Switching Frequency	kHz	10.5	10.5	10.5	10.5	10.5	10.5
PREAMPLIFIER							
Input Impedance	kOhm	22					
Velocity/Current Command	V	0 to +/- 10					
Gain Stability	%	+/- 1					
Gain Linearity	%	+/- 2					
Drift (referred to input)	μV/°C	+/- 10 max.					
Offset		adjustable to zero					
FEEDBACK CIRCUIT (Resolver)							
Resolution		12 Bit					
Encoder Simulation Option "C"	ppr	100 / 200 / 500 / 1000					
Signal Reference Pulse		5 V TTL A, \bar{A} B, \bar{B} C, \bar{C} non-adjustable					
MECHANICAL							
Mounting Dimensions	6 HE mm	Rack 220x60					Rack 220x120
Weight	kg	RL: 0.9 R: 1.4					3.6
POWER SUPPLY BPS 10 R							
Input Voltage 3-phase		V AC	140.0 ± 20 %				
Output Voltage		V DC	200.0 ± 20 %				
Cont. Output Current		A	20.0	40.0	60.0		
Max. Output Current 2.5 s		A	40.0	80.0	120.0		
Nominal Power		kW	4.0	8.0	12.0		
Regeneration Switching Current		A	20.0	20.0	20.0		
Regeneration Resistor (internal) ²		W	80.0	80.0	80.0		
MECHANICAL							
Mounting Dimensions		mm	Rack 6 HE 220 x 60				
Weight		kg	1.0				
TEMPERATURE BTS/BPS 10 R							
Ambient for Nominal Ratings		deg.C	25				
Operating Range		deg.C	0 to +45				
Storage		deg.C	-20 to +70				

¹ 24/48 V also available ² or 320 W external on order



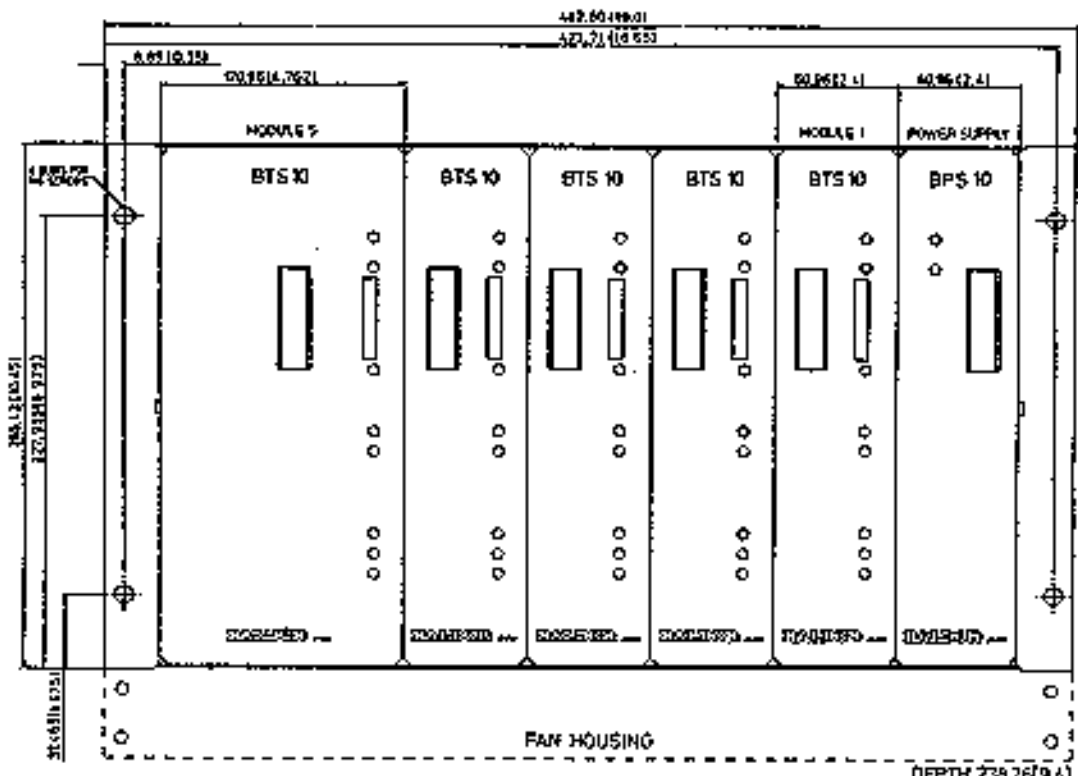
DRAWING NUMBER

DATE	REV	BY	CHKD	APP'D	DESCRIPTION
02-25-78	1				RESOLVER AND CONTROL CARD FUNCTIONAL BLOCK DIAGRAM
BALDOR					
# 16951 A					REV. #1



DRAWING NUMBER

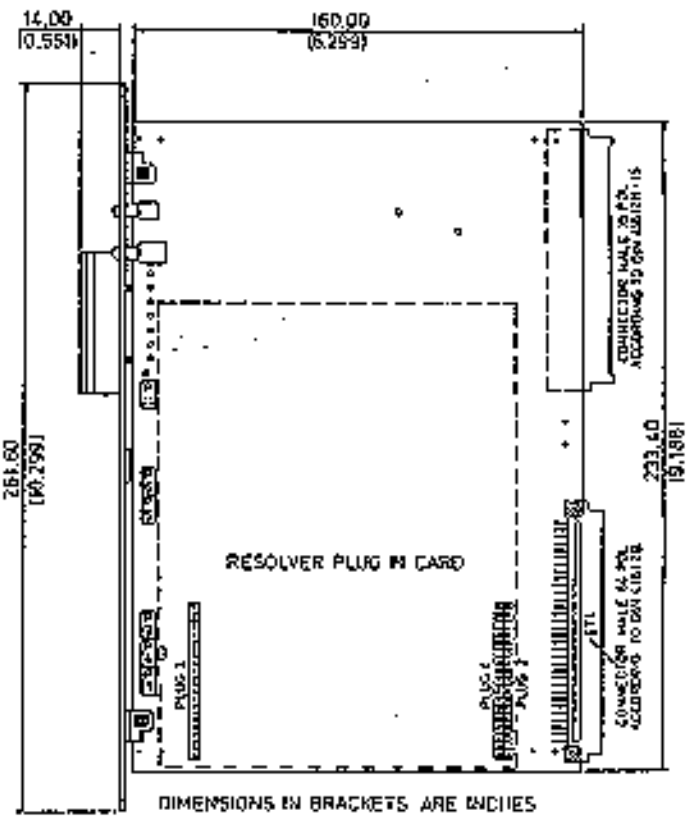
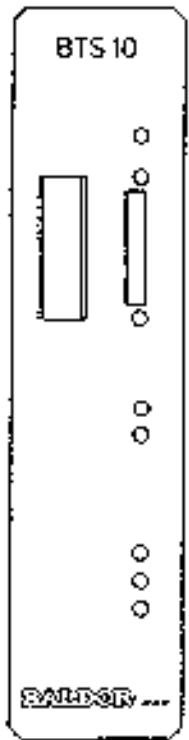
REV	DATE	BY	CHKD	APPROVED	DESCRIPTION	SCALE	QTY
1					RESOLVER AND CONTROL CARD FUNCTIONAL BLOCK DIAGRAM	1:1	
17894 A EVALUATOR ASR							



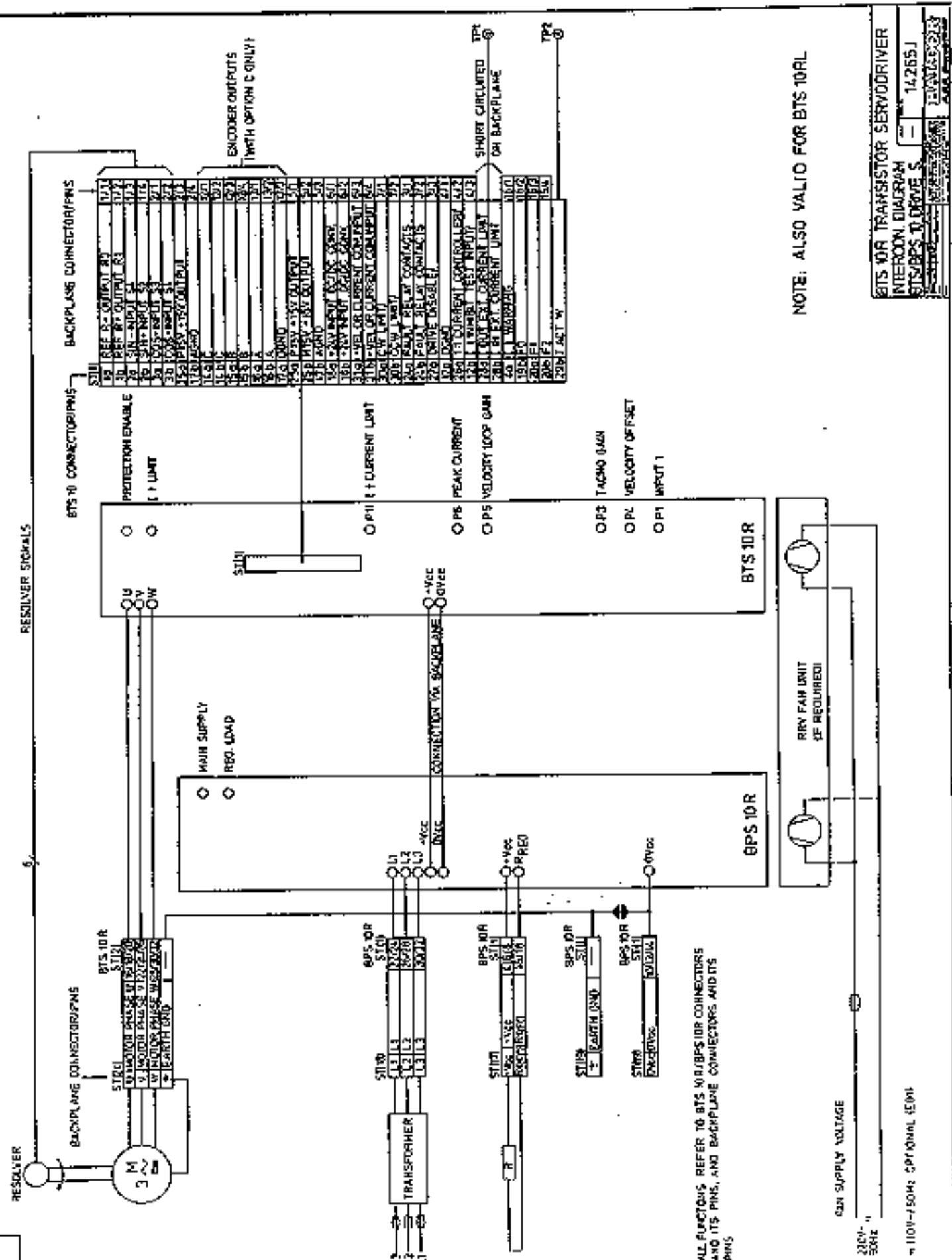
AIR FLOW

DIMENSIONS IN BRACKETS ARE INCHES

PART NO. 16181 C	
TITLE: MECHANICAL SYSTEM CONFIG.	
DATE: 10/15/81	BY: [Signature]
CITY: MILWAUKEE, WI	REV: 0
DESIGNER: [Signature]	DATE: 10/15/81
PROJECT: [Signature]	SCALE: 1:1
<p>FOR THE CUSTOMER'S USE:</p> <p>DATE: 10/15/81</p> <p>BY: [Signature]</p> <p>SCALE: 1:1</p>	
<p>FOR THE MANUFACTURER'S USE:</p> <p>DATE: 10/15/81</p> <p>BY: [Signature]</p> <p>SCALE: 1:1</p>	
<p>FOR THE ASSEMBLER'S USE:</p> <p>DATE: 10/15/81</p> <p>BY: [Signature]</p> <p>SCALE: 1:1</p>	
<p>FOR THE MAINTENANCE PERSONNEL'S USE:</p> <p>DATE: 10/15/81</p> <p>BY: [Signature]</p> <p>SCALE: 1:1</p>	



BALDOR



BACKPLANE CONNECTOR/PINS

17A	REF 0 - OUTPUT 80
17B	REF 0 - OUTPUT 81
17C	SIN - OUTPUT 82
17D	SIN - OUTPUT 83
17E	SIN - INPUT 84
17F	SIN - INPUT 85
17G	POS - OUTPUT 86
17H	POS - OUTPUT 87
17I	POS - INPUT 88
17J	POS - INPUT 89
17K	REF 1 - OUTPUT 90
17L	REF 1 - OUTPUT 91
17M	REF 1 - OUTPUT 92
17N	REF 1 - OUTPUT 93
17O	REF 1 - INPUT 94
17P	REF 1 - INPUT 95
17Q	REF 1 - INPUT 96
17R	REF 1 - INPUT 97
17S	REF 1 - INPUT 98
17T	REF 1 - INPUT 99
17U	REF 1 - INPUT 100
17V	REF 1 - INPUT 101
17W	REF 1 - INPUT 102
17X	REF 1 - INPUT 103
17Y	REF 1 - INPUT 104
17Z	REF 1 - INPUT 105
18A	REF 2 - OUTPUT 106
18B	REF 2 - OUTPUT 107
18C	REF 2 - OUTPUT 108
18D	REF 2 - OUTPUT 109
18E	REF 2 - INPUT 110
18F	REF 2 - INPUT 111
18G	REF 2 - INPUT 112
18H	REF 2 - INPUT 113
18I	REF 2 - INPUT 114
18J	REF 2 - INPUT 115
18K	REF 2 - INPUT 116
18L	REF 2 - INPUT 117
18M	REF 2 - INPUT 118
18N	REF 2 - INPUT 119
18O	REF 2 - INPUT 120
18P	REF 2 - INPUT 121
18Q	REF 2 - INPUT 122
18R	REF 2 - INPUT 123
18S	REF 2 - INPUT 124
18T	REF 2 - INPUT 125
18U	REF 2 - INPUT 126
18V	REF 2 - INPUT 127
18W	REF 2 - INPUT 128
18X	REF 2 - INPUT 129
18Y	REF 2 - INPUT 130
18Z	REF 2 - INPUT 131
19A	REF 3 - OUTPUT 132
19B	REF 3 - OUTPUT 133
19C	REF 3 - OUTPUT 134
19D	REF 3 - OUTPUT 135
19E	REF 3 - INPUT 136
19F	REF 3 - INPUT 137
19G	REF 3 - INPUT 138
19H	REF 3 - INPUT 139
19I	REF 3 - INPUT 140
19J	REF 3 - INPUT 141
19K	REF 3 - INPUT 142
19L	REF 3 - INPUT 143
19M	REF 3 - INPUT 144
19N	REF 3 - INPUT 145
19O	REF 3 - INPUT 146
19P	REF 3 - INPUT 147
19Q	REF 3 - INPUT 148
19R	REF 3 - INPUT 149
19S	REF 3 - INPUT 150
19T	REF 3 - INPUT 151
19U	REF 3 - INPUT 152
19V	REF 3 - INPUT 153
19W	REF 3 - INPUT 154
19X	REF 3 - INPUT 155
19Y	REF 3 - INPUT 156
19Z	REF 3 - INPUT 157

NOTE: ALSO VALID FOR BTS 10RL

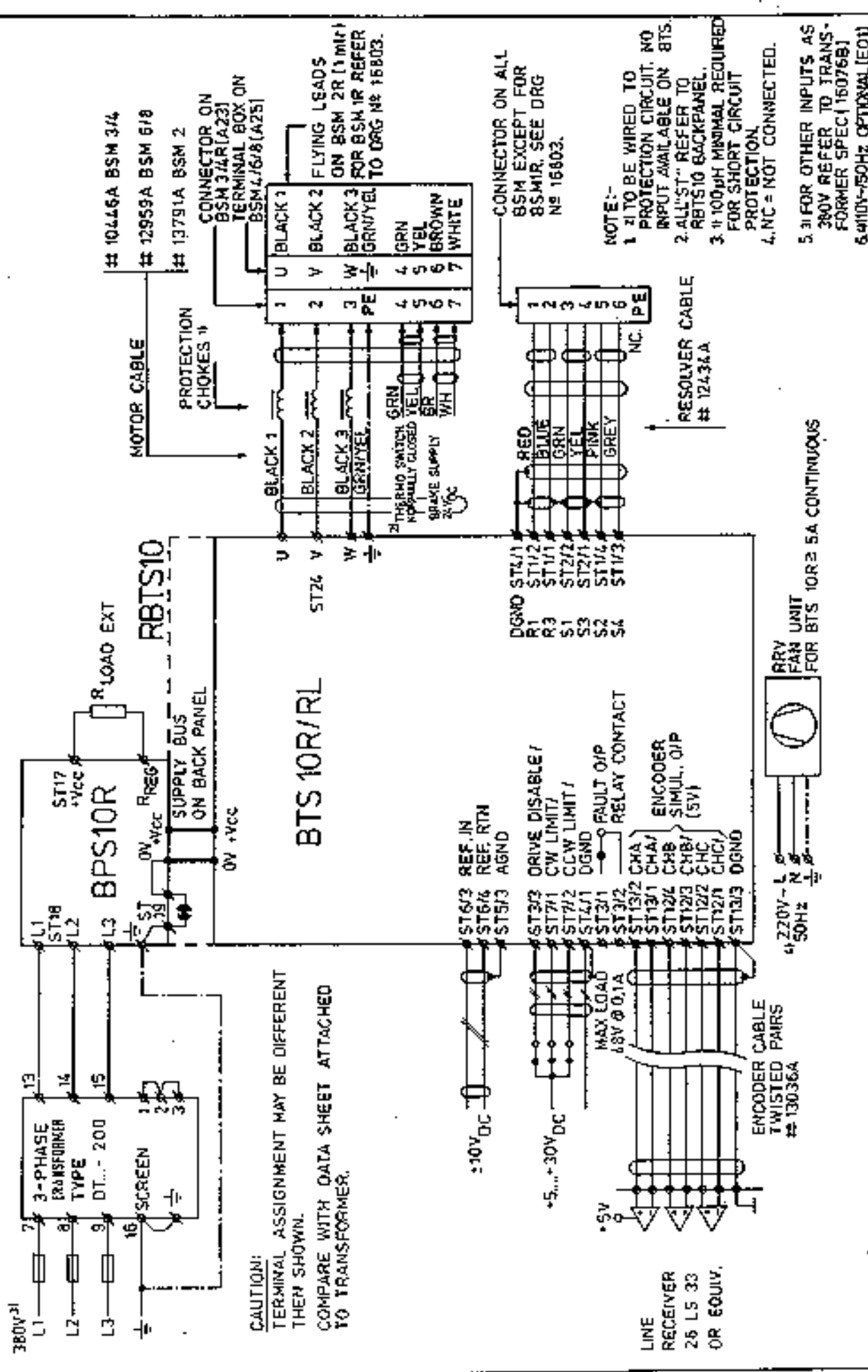
BITS 10R TRANSISTOR SERVO DRIVER
 INTERCON. DIAGRAM
 SITS/BPS TO DRIVE S

14-265J

ALL FUNCTIONS REFER TO BTS 10R/BPS 10R CONNECTORS AND ITS PINS, AND BACKPLANE CONNECTORS AND ITS PINS

220V-50Hz
 CAN SUPPLY VOLTAGE

110V-150Hz OPTIONAL (EOM)



REV	DATE	BY	CHKD	DESCRIPTION
1				
2				
3				

NO. 9	DATE	REV	BY	CHKD	DESCRIPTION
1					
2					
3					

NO. 9	DATE	REV	BY	CHKD	DESCRIPTION
1					
2					
3					

NO. 9	DATE	REV	BY	CHKD	DESCRIPTION
1					
2					
3					

15240E

15240E

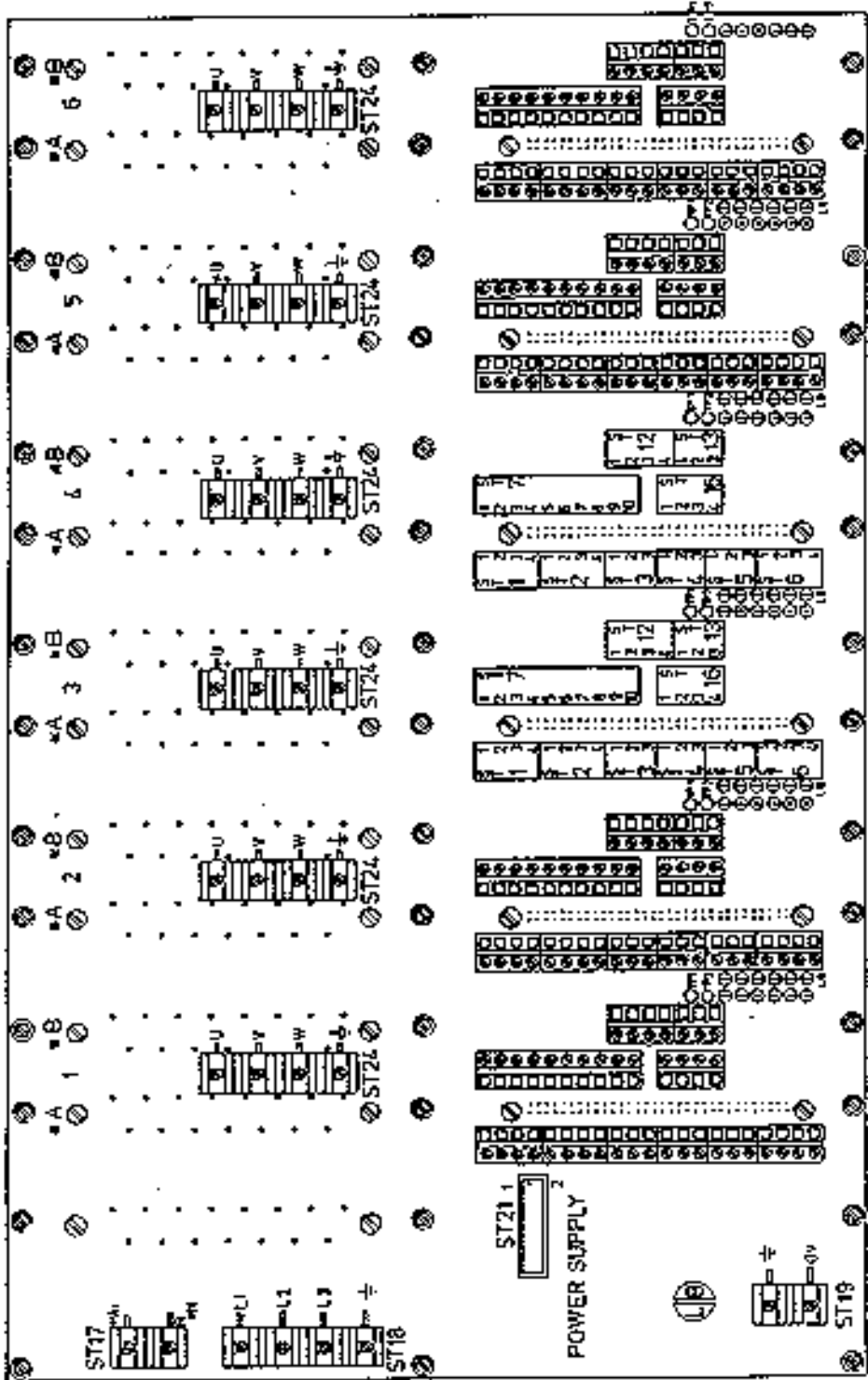
RBTS 10R/RL CONNECTION DIAGRAM FOR RESOLVER BASED SYSTEM

15240E

ASR

NOTE:-
 1. TO BE WIRED TO PROTECTION CIRCUIT. NO INPUT AVAILABLE ON BTS.
 2. ALL "ST" REFER TO RBTS10 BACKPANEL.
 3. 100µH MINIMAL REQUIRED FOR SHORT CIRCUIT PROTECTION.
 4. NC = NOT CONNECTED.
 5. FOR OTHER INPUTS AS 380V REFER TO TRANSFORMER SPEC (16076B).
 6. 110V-150Hz OPTIMAL (E01)

COMPONENT SIDE VIEW



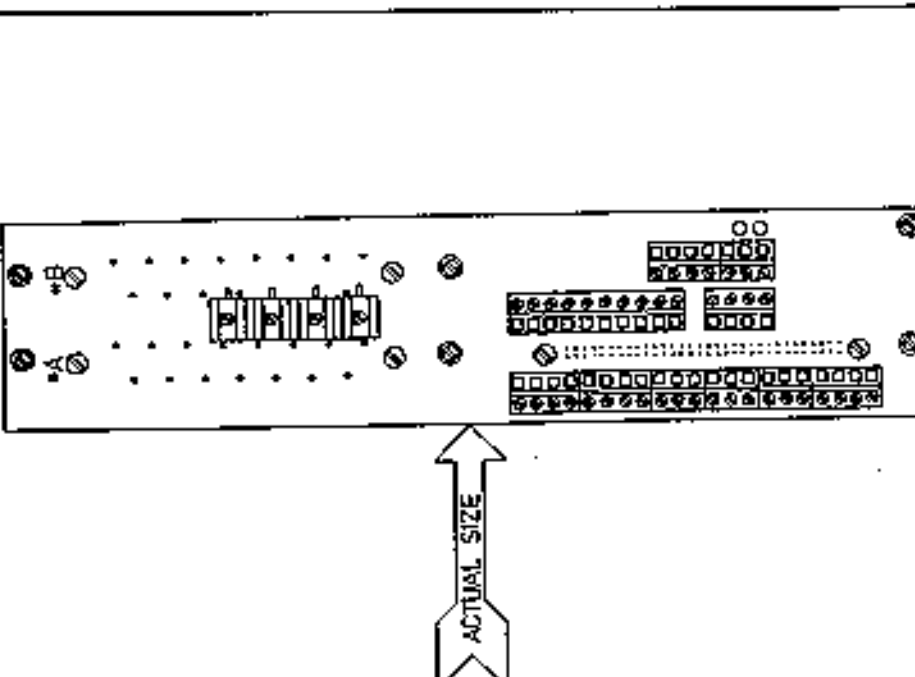
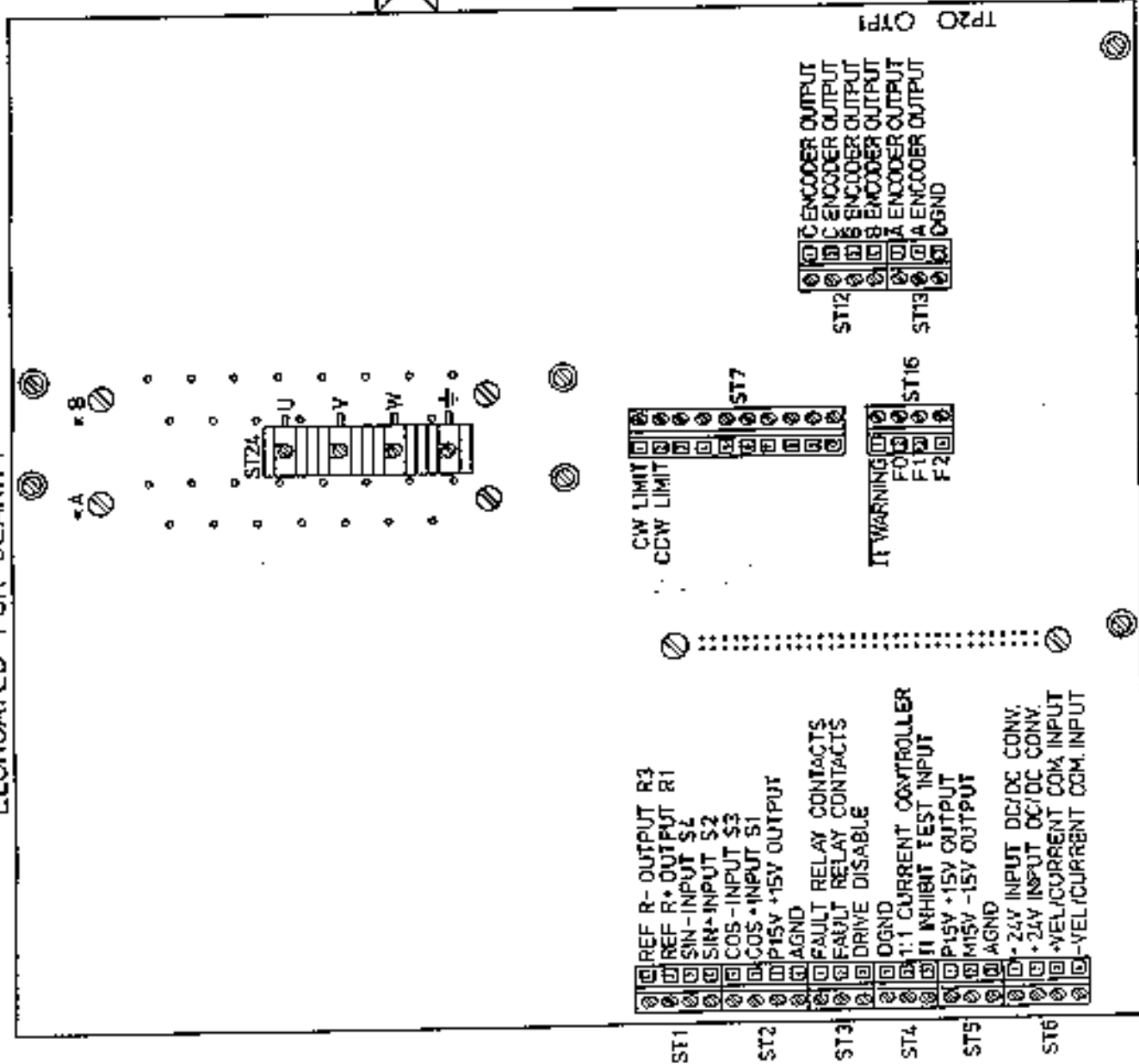
NOTE:-

- A- POWER CONNECTOR FOR BITS 10RL VERSION
- B- POWER CONNECTOR FOR BITS 10R VERSION
- 1. HOLES MARKED THUS: -⊙ ARE SOLDER STUDS.
- 2. BOTH X SECTIONS ARE ASSEMBLED AS PER Y SECTION.

BIT 5 10R/7L RACK BACK PLANE (COMPLETE) ASSEMBLY DRAWING (COMP. SIDE)		REV	1:1
15206C		RAYMOND A.S.A. CORPORATION	

14908B

ELONGATED FOR CLARITY



ACTUAL SIZE

NOTE:-
 *A= POWER CONNECTOR FOR BTS10RL VERSION
 *B= POWER CONNECTOR FOR BTS10R VERSION
 I OUT EXT. CURRENT LIMIT } SHORT CIRCUITED
 I IN EXT. CURRENT LIMIT } ON BACK PLANE
 I ACT W

BTS10R TRANSISTOR SERVO DRIVER
 RACK BACK PLANE (SINGLE AXIS)
 PIN DESIGNATION DIAGRAM

REV.	DATE	BY	CHKD	APP'D	QTY	NTS	14908B

BTS 10 R/RL - SET-UP PROCEDURE

Encoder Output/Pole Pair Select

By means of a 5-way Dip switch it is possible to select the encoder resolution and the number of poles of the connected brushless motor.

The switch is located on the top card or resolvercard (see page 10).

1. Pole Pair Select

Number of pole pairs	S1/1	S1/2	S1/3	Motortype	Option
1	OFF	OFF	OFF	BSM 2 R	B01
2*	ON	OFF	OFF	BSM 1/3/4 R	B02
3	OFF	ON	OFF	BSM 6 R	B03
4	ON	ON	OFF	BSM 4/6/8 F	B04
5	OFF	OFF	ON		
6	ON	OFF	ON	* set ex	*
7	OFF	ON	ON	works	
8	ON	ON	ON		

2. Max. Speed Setting

R 38 = 422 k Ω , 1 $\frac{1}{2}$, 0,5 W standard for 2000 rpm motors

R 38 = 221 k Ω , 1 $\frac{1}{2}$, 0,5 W standard for 4000 rpm motors *

R 38 = 150 k Ω , 1 $\frac{1}{2}$, 0,5 W standard for 6000 rpm motors

For location of R 38 see page 10. * fitted ex works

3. Encoder Simulation*² (Option C)

Pulses/Rev.	S1/4	S1/5	Option	
1000*	OFF	OFF	C08	* set ex works
500	ON	OFF	C07	
250	OFF	ON	C06	
100	ON	ON	C05	

Note: Other resolutions available on request

*² EPROM IC 13 # 15996

4. Velocity or Current Mode

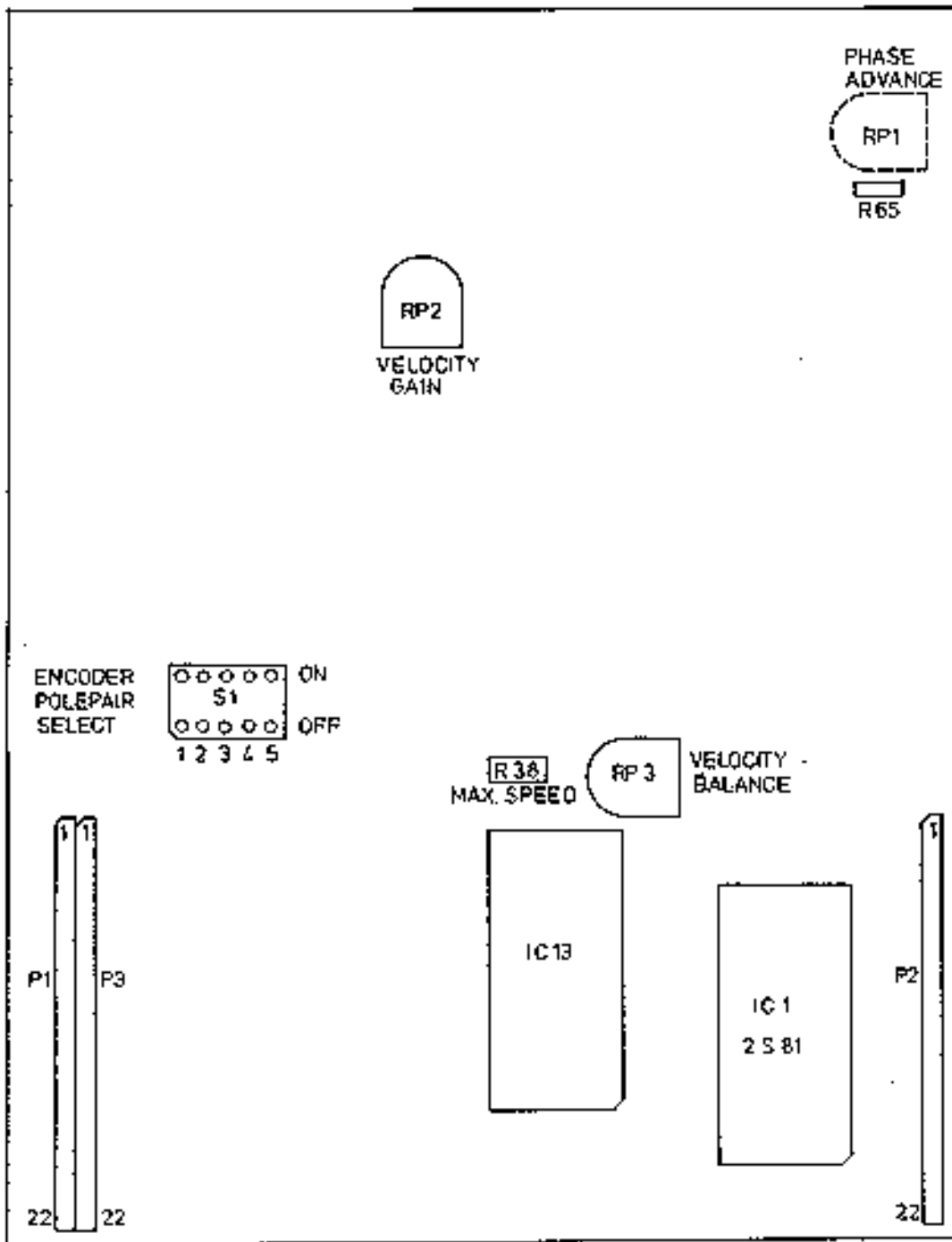
With control input "1:1" on ST 4/2 it is possible to use the amplifier as velocity controller or current controller.

When taken "low", the velocity feedback is switched out and the input gain is set to unity. With P1 and P6 set fully CW the overall gain is: $G = \frac{I_{pk}}{9,65} (A/V)$.

LB 101 has to be open.

5. Phase Advance

The generated current in each winding lags the current command as a function of shaft velocity. This is due to the current loop bandwidth, limited by the fixed intermediate bus voltage.



NOTE: ACTUAL COMPONENT PLACEMENT
 MAY DIFFER FROM SHOWN
 COMPONENT LAYOUT
 R38 ON SOLDER POINT
 RP2, RP3 SET AT FACTORY
 RP1 OPTIONAL

REV	DATE	NAME	REV. NO.	QUANTITY	DESCRIPTION	DATE	BY
0001	08/10/80
0002
0003
0004
0005
0006
0007
0008
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0010
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0097
0098
0099
0100

15473 C

BTS 10 R-CARD 3
 REDUCED COMP. LAYOUT

REVALDOB A S R

BTS 10 R/RL - SET-UP PROCEDURE (CONTINUATION)

To produce max. torque per ampere the real current vector (or torque producing) must be in phase with the EMF of the motor. Advancing the phase angle must be performed as a function of motor speed and electrical time constant. R65 located on the resolvercard (see page 10) determines the amount of phase advance. With the standard value (R65 = 26,7 k Ω) the current efficiency is approx. 90 ... 95 %.

For all BSM R/F motors the optimum resistor value is available on request.

Note: Wrong resistor values may lead to speed limiting.

6. Voltage check

The BTS 10 R/RL work on 200 V DC nominal with a maximum working voltage of 240 V DC. The 3-phase transformer should have an AC-output of 140 V nominal or 169 V max. @ no load (starconfiguration line to line voltage).

Note: The voltage check should be made with all amplifiers removed. The AC-supply should be measured without BPS 10 R, the DC-supply with BPS 10 R.

7. Potentiometer Preset

Equip chassis with BTS 10 R/RL amplifiers and BPS 10 R power supply and set the potentiometers as follows:

- a) RP 1 (command input) clockwise for max. input gain
- b) RP 3 (velocity feedback gain) clockwise for max. gain
- c) RP 5 (velocity loop gain) anti-clockwise for min. gain
- d) RP 6 (peak current) anti-clockwise for reduced current

8. Speed Adjust

- a) Remove command signal lines and short circuit input (ST 6/3 and ST 6/4)
- b) Power on. Turn RP6 slowly clockwise until motor develops torque. If no torque - check CW/CCW limit and total disable inputs. If motor shaft accelerates - check resolver wiring.
- c) Adjust RP4 (velocity offset) until motor comes to a complete rest.
- d) Connect command signal and adjust speed with RP 1 and RP3 as necessary in your application.
- e) Check offset again.

9. Response Optimization

The step response can be optimized with the velocity loop gain potentiometer RP5.

In order to achieve proper adjustment it is necessary to observe the current waveform on TP5 with an oscilloscope. RP5 is adjusted properly when the current waveform shows a single overshoot on applying a step command. At constant velocity the AC-component on TP5 should be kept as low as possible but should not exceed 2 Vpp in order to avoid excessive motorheating.

POTENTIOMETERS ON BTS 10 R/RL

For location of potentiometers on BTS 10 R see page 16, drawing no. 14642. For location of potentiometers on BTS 10 RL see page 17, drawing no. 17903.

- RP1 - Input gain
velocity or current
fully CW $\hat{=}$ unity gain.
- RP4 - Velocity offset adjust
zero speed adjust for zero command
- RP3 - Velocity feedback gain
has to be adjusted to reference speed.
Fully CW $\hat{=}$ max. gain.
- RP5 - Velocity loop gain adjust
adjusts the frequency response of the velocity control loop.

Turning RP5 clockwise results in an increasing high frequency gain with possibly negative effects (motor-heating). It is extremely important to observe TP5 with an oscilloscope when adjusting RP5. For most applications there is no need to increase the AC-gain and RP5 is set to fully CCW.

- RP6 - Peak current adjust
sets peak current level which can be measured on TP5.
Fully CW $\hat{=}$ max. I_{pk}

- RP11 - It current limit adjust
sets current limit level.
Fully CW $\hat{=}$ I nominal.

Note: RP1, RP3, RP5, RP6 and RP11 can be substituted by fixed resistors on headers J2 and J3.

BTS 10 R/RL - TESTPOINTS

To allow effective set-up of the amplifier and its control loop several testpoints are accessible on the front side as well as on the backpanel (BTS 10 R - see page 16; BTS 10 RL - see page 17). Since most signals have alternating waveform it is recommended to use an oscilloscope for measuring purposes. All signals are related to TP8 (GND).

Caution: To avoid ground loops and interference it is strongly advised to isolate the measuring equipment from neutral (earth).

TP9: PWM signal
20 Vpp, 10,5 kHz triangle
(for test purposes only)

TP1: Actual rms current phase U
 $I_{pk} \approx 10,0$ V

TP2: Actual rms current phase V
 $I_{pk} \approx 10,0$ V

TP3: Actual rms current phase W
 $I_{pk} \approx 10,0$ V

Note: For torque calculations referring to the actual current the formula is:

$$T = 3 \text{ KT} \frac{V_{TP} \cdot I_{pk}}{10,0} \quad (\text{for rotating motorshaft only})$$

where T = Motortorque (Nm)

KT = Torque constant per phase (Nm/A)

V TP = Voltage on TP 1, 2 or 3

I_{pk} = peak rms current rating of amplifier BTS 10 R/RL
($I_{pk} \approx 2 \cdot I_{nom.}$)

TP5: $I_{command}$

This is the output signal of the velocity control loop
9,25 V max. \approx amplifier's peak current.
The voltage level is proportional to rms output current.
TP5 is the major testpoint to look at during set-up. The voltage level can be easily converted to accel/deccl torque or friction by using the motor torque constant.

BTS 10 R/RL - TESTPOINTS (CONTINUATION)

The signal waveform is DC with a superimposed alternating component. As a general rule, current saturation should be avoided at all times in position controls. The AC component must be kept as low as possible since this leads to heatdissipation in the motor (see potentiometer RP5).

Note: On BTS 10 R, TP 5 shows the current command before it limiting. Be sure, that it limit is off - otherwise current-reading will be false.

TP6: Velocity command signal (or current command when 1:1 input on ST 4/2 taken low) shows input signal after attenuator RP1

TP7: Actual velocity

This signal is derived from the resolver to digital converter and is used as velocity feedback. Standard output 2,5 V/krpm (R38 = 221 k Ω) for 4000 rpm motors. For 6000 rpm motors R38 = 150 k Ω and V TP7 = 1,33 V/krpm, for 2000 rpm motors R38 = 422 k Ω and V TP7 = 5,0 V/krpm.

Accuracy: \pm 5 %

Ripple: typ. 1 % @ 10 V

Offset: \pm 150 mV max.

Note: To avoid RDC saturation, the voltage level at TP7 should not exceed \pm 10,0 V.

Testpoints on backpanel:

TP1: $I_{command}$ = 9,65 V \approx I_{peak} rms (see also TP5)

TP2: see TP3

IDENTITY HEADERS J2 AND J3

On the Identity Headers all important potentiometers can be substituted by fixed resistors (see page 16 for BTS 10 R; see page 17 for BTS 10 RL).

Also the frequency response components for the velocity and current loop are located here.

Header J2

For the velocity loop and its variable components on J2 please refer to the drawings on pages 16 and 20 for BTS 10 R and on pages 17 and 21 for BTS 10 RL.

Notes:

1. R 103 avoids setting of RP1 (RP1 set to fully CW)
2. R 101 avoids setting of RP3 (RP3 set to fully CW)
3. RP5 = 20 k Ω
4. RP6 = 20 k Ω
5. Standard values: R101, R103 = 22,1 k Ω
R93 = 332 Ω , R94 = 332 k Ω , C19 = 47 nF

Header J3

Here are the PI components for the current loops of phase U and phase V.

Proportional gain = R43 and R44 (150 k Ω , 100 k Ω on RL)

Integral gain = C17 and C11 (4,7 nF)

Note: For most applications the standard values will give good performance of the current loop.

Its functioning can be verified on TP1 through TP3:

The current waveform should be smooth and not have excessive 10,5 kHz (PWM) components.

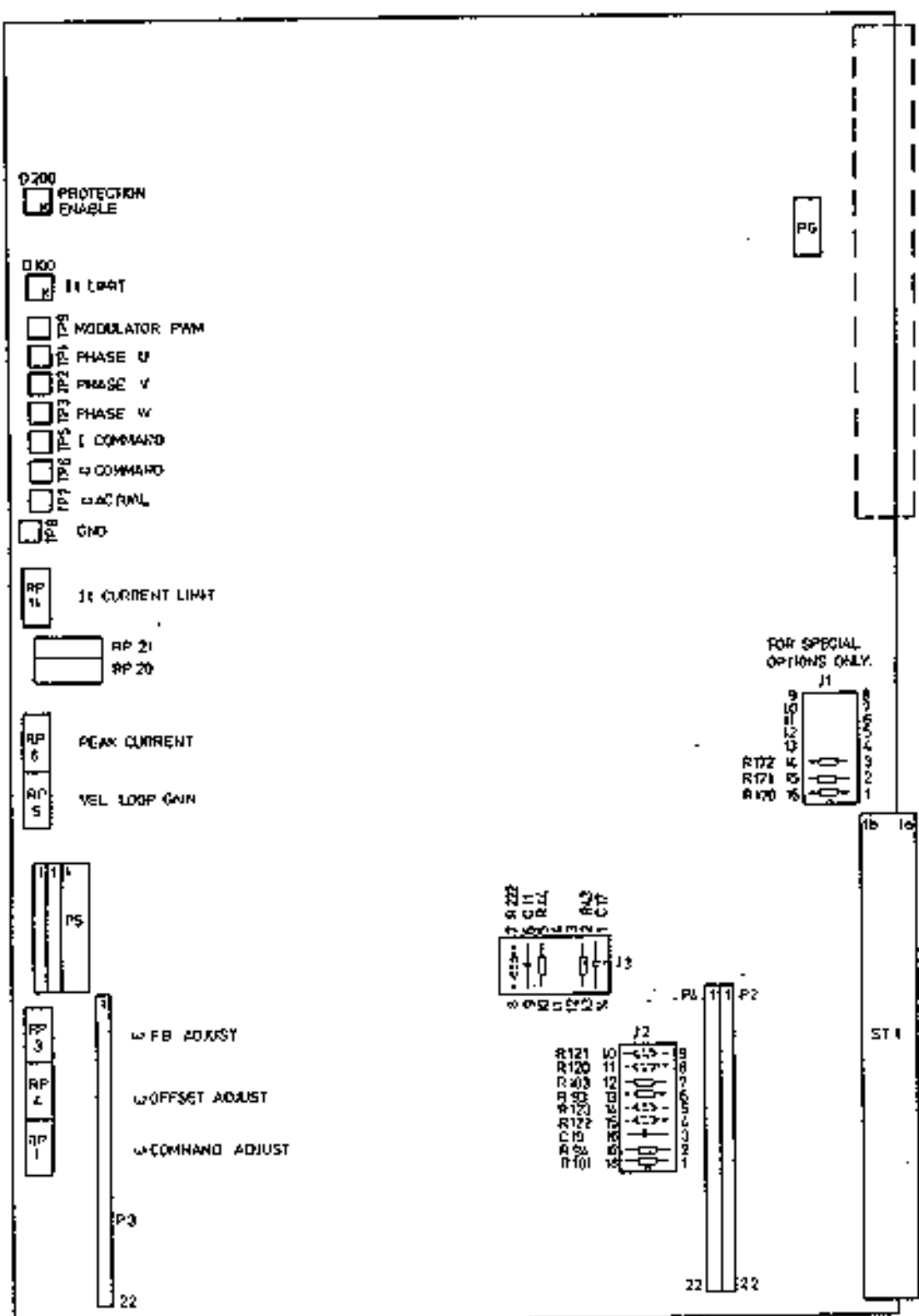
The substitution of RP 11 - It limit is R 222.

On BTS 10 R, R 222 is located on header J3; on BTS 10 RL, R 222 is located near J3.

It limit = R 222 (with RP11 removed)

I limited = $\frac{R\ 222}{R\ 222 + 20\ k} \cdot I_{max}$ (R222 = 20 k Ω max.)

LOCATION OF TESTPOINTS, POTENTIOMETERS AND COMPONENT HEADERS
ON BTS 10 R CONTROL CARD

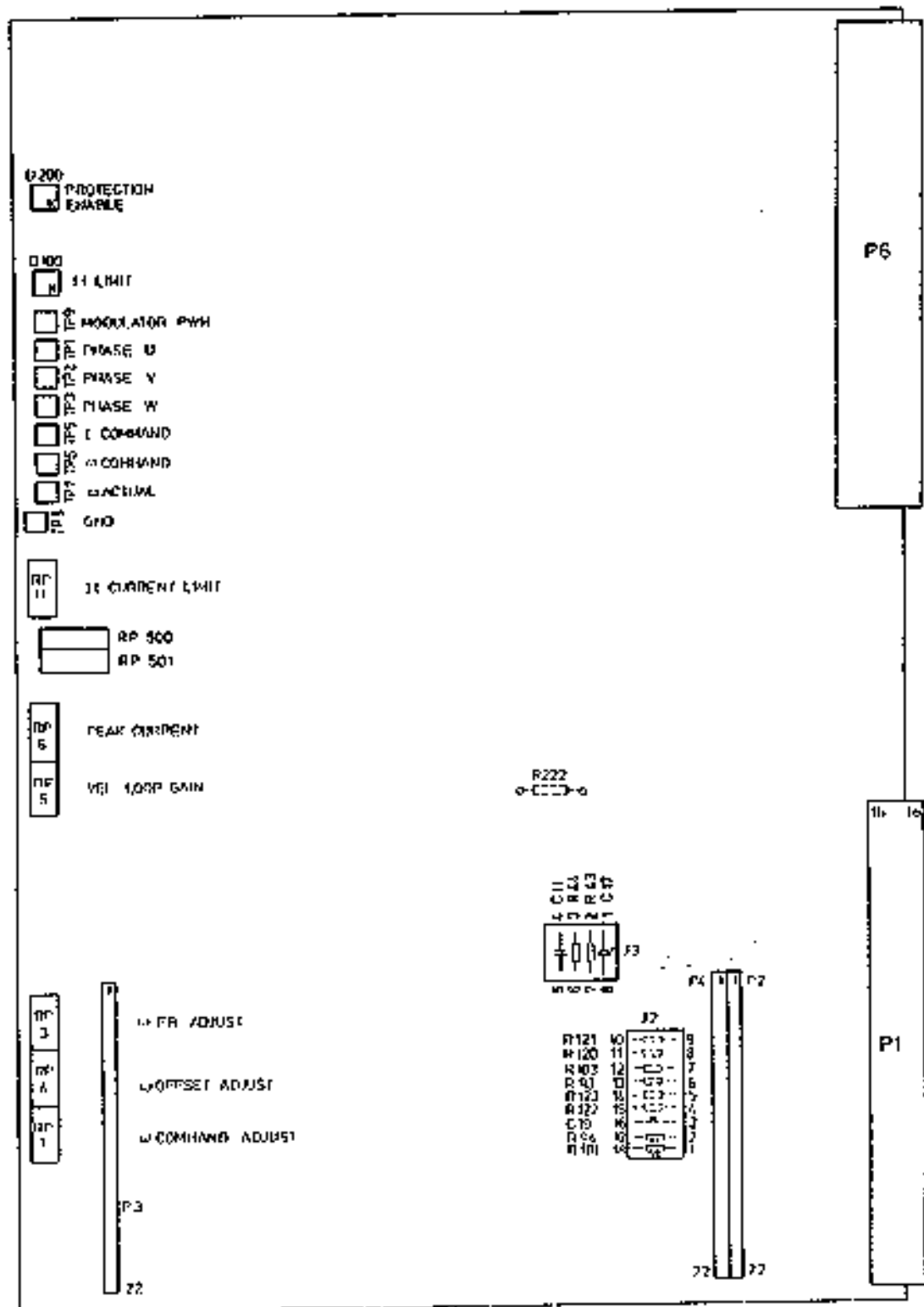


PROTECTIVE FUSIBLE	INDICATED	INDICATED	INDICATED
BTS 10R CONTROL CARD VARIABLE COMPONENTS			
SCALE	14642		
DATE	REV	REV	REV
15/11/80	1	1	1
CHKD	BY	BY	BY
15/11/80	1	1	1

14642
14642
14642

FOR SPECIAL
OPTIONS ONLY.

LOCATION OF TESTPOINTS, POTENTIOMETERS AND COMPONENT HEADERS ON BTS 10 RL CONTROL CARD



PART NUMBER 17903A	REVISION A	DATE 15 10 68	DRAWN BY A	CHECKED BY A
BTS 10 RL CONTROL CARD VARIABLE COMPONENTS				
THE FOLLOWING TABLE LISTED THE VARIABLE COMPONENTS WHICH ARE USED IN THE CONTROL CARD. THE PART NUMBER OF EACH COMPONENT IS LISTED IN THE FIRST COLUMN. THE PART NUMBER OF THE CONTROL CARD IS LISTED IN THE SECOND COLUMN. THE PART NUMBER OF THE VARIABLE COMPONENT IS LISTED IN THE THIRD COLUMN. THE PART NUMBER OF THE VARIABLE COMPONENT IS LISTED IN THE FOURTH COLUMN.				
PART NUMBER	CONTROL CARD	VARIABLE COMPONENT	PART NUMBER	PART NUMBER
17903A	17903A	R1	R1	R1
17903A	17903A	R2	R2	R2
17903A	17903A	R3	R3	R3
17903A	17903A	R4	R4	R4
17903A	17903A	R5	R5	R5
17903A	17903A	R6	R6	R6
17903A	17903A	R7	R7	R7
17903A	17903A	R8	R8	R8
17903A	17903A	R9	R9	R9
17903A	17903A	R10	R10	R10
17903A	17903A	R11	R11	R11
17903A	17903A	R121	R121	R121
17903A	17903A	R122	R122	R122
17903A	17903A	R123	R123	R123

17903 A

RAIDOR ASN

BTS 10 R/RL - I/O HARDWARE AND FUNCTION

INPUTS

Velocity or current differential Input
 V in max. = $\pm 10 V_{DC}$

CW Limit
 high = enable
 V in max. = $+ 5 \dots + 30 V_{DC}$

CCW Limit
 high = enable
 V in max. = $+ 5 \dots + 30 V_{DC}$

Note: CW/CCW Limits disable amplifier, no active braking.

Drive Disable
 high = enable
 V in max. = $+ 5 \dots + 30 V_{DC}$

1 : 1 Current control, active low.
 Sets velocity loop gain to unity and velocity (tacho) feedback to zero for use of current amplifier only.

Resolver Sine S 4

Resolver Sine S 2

Resolver Cosine S 3
 Resolver Cosine S 1
 Signal waveform sinusoidal
 7,2 kHz, 10 Vpp

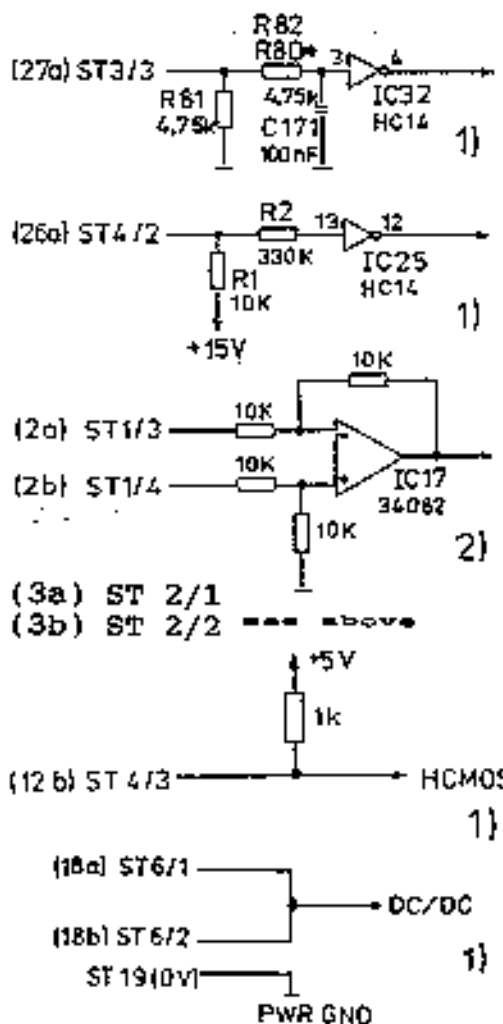
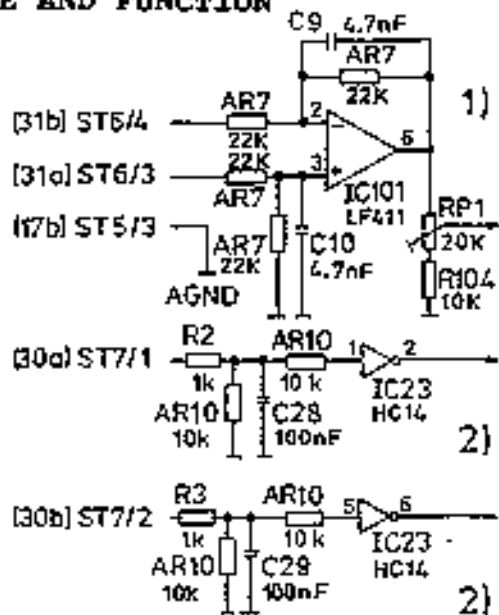
It Inhibit Test

Note: For test purposes only, low disables electronic fusing.

+ 24 V_{DC} Input for Control logic supply (optional)

Inputrange + 18 ... + 60 V_{DC}

Inputpower 40 W



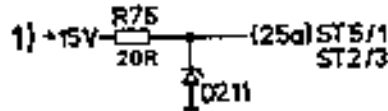
- 1) On Control Card
- 2) On Resolver Card
- *) For BTS 10 RL

BTS 10 R/RL - I/O HARDWARE AND FUNCTION

OUTPUTS



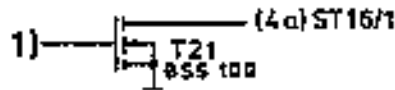
Fault relay contacts, open when fault.
max. load: 48 V_{DC} @ 100 mA



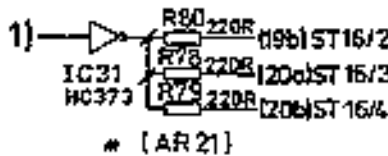
+ 15 V @ 20 mA



- 15 V @ 20 mA



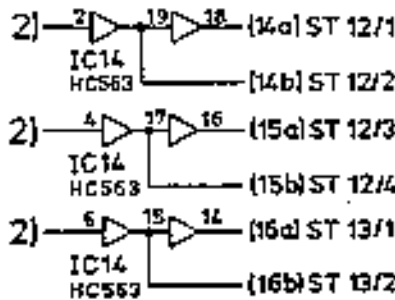
It warning
max. load + 30 V @ 50 mA
active low



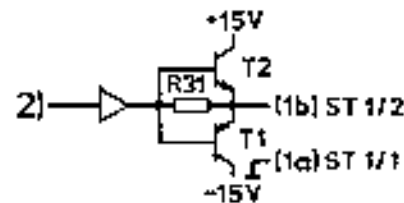
F0 Error code
F1 5 V output
F2

F0	F1	F2	
0	0	0	OK (BTS 10 is happy)
0	0	1	Overtemperature
0	1	0	Overvoltage
0	1	1	Electronic Fuse
1	0	0	Overcurrent
1	0	1	Resolver Fault
1	1	0	Overcurrent
1	1	1	IT warning, electronic
			Supply error 15 sec.

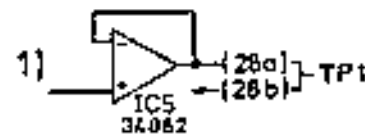
Note: IT warning not latched. All 0.5sec. max.



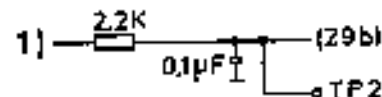
CHC / Encoder outputs
CHB / V_{OH} ≥ + 4,5 V CW ROTATION:
CHB V_{OL} ≤ + 0,2 V
CHA / I_{OUT} ≤ 5 mA
CHA Not short circuit proof



Resolver Reference R 3 Signal waveform
Resolver Reference R 1 sinusoidal
7,2 kHz,
21 Vpp



Current command signal
9,65 V_{DC} = I_{PK}
load ≥ 10 kΩ

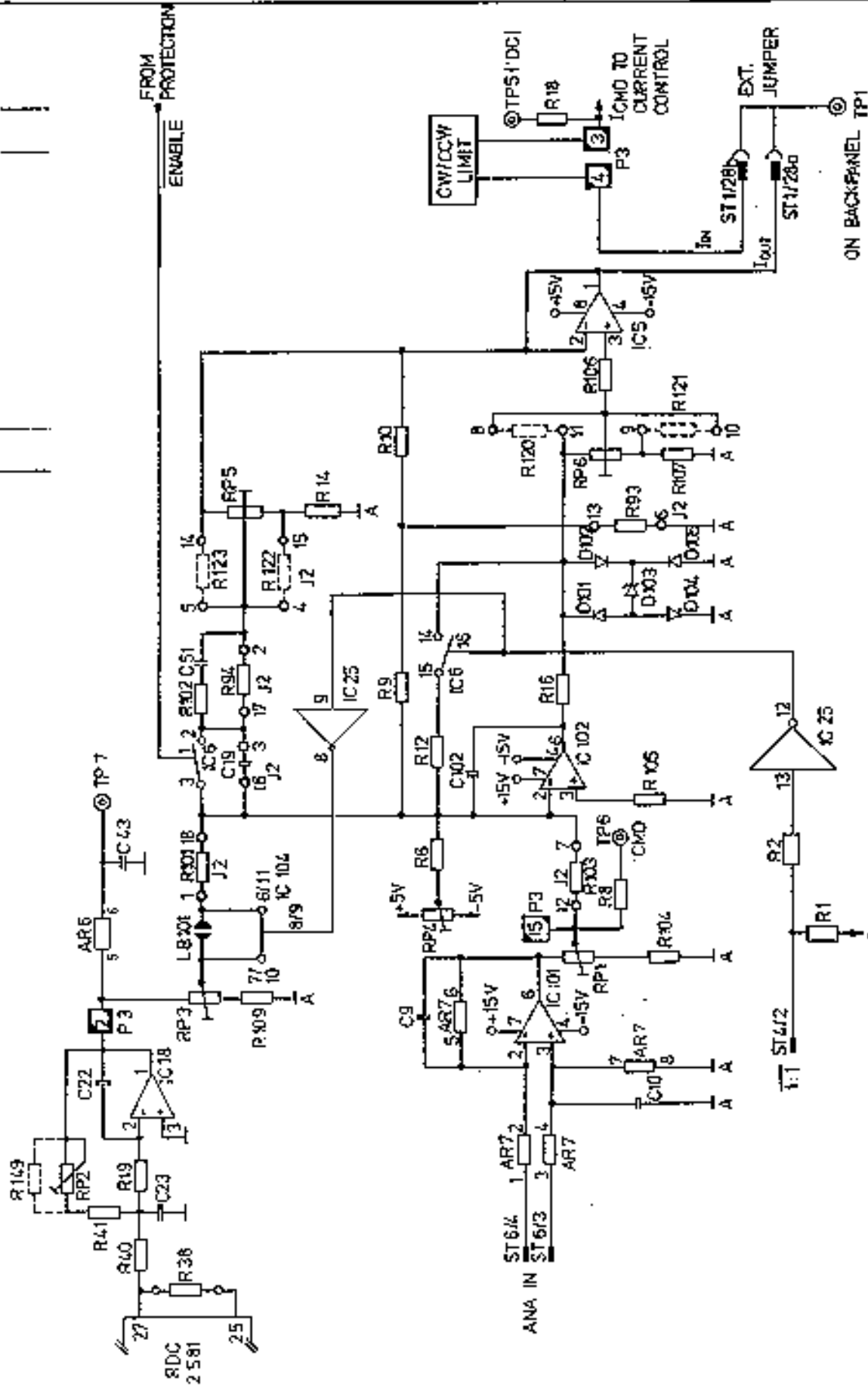


Phase current
I_w actual
10,0 V = I_{PK}

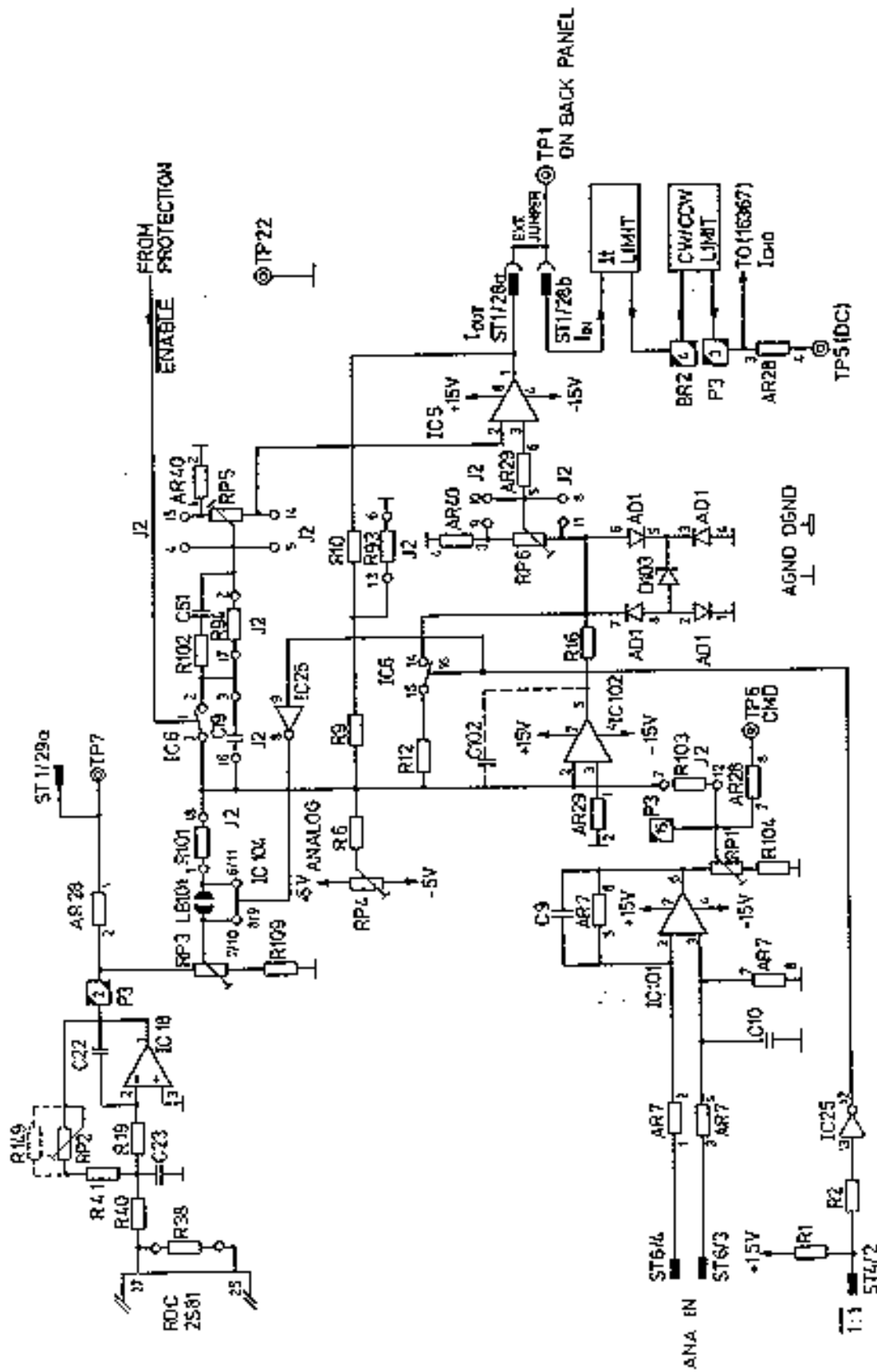
Note: TP 1 and TP 2 on backpanel.

1) On Control Card
2) On Resolver Card
*) For BTS 10 RL

REV/ISS	DESCRIPTION	DATE	APPROVED



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<p>REF DRAWING NO</p>	<p>DRAWING NUMBER</p>
<p>15274C</p>	
<p>TITLE SCHEMATIC OF BTS 10R VELOCITY CONTROL WITH VARIABLE COMPONENTS</p>	
<p>DATE</p>	
<p>BY</p>	
<p>APPROVED</p>	
<p>REVISIONS</p>	
<p>REV. NO. DATE DESCRIPTION</p>	
<p>1 11/87 15274C</p>	



REV 01	DATE	NAME	QUANTITY
00001170.03	03/10/83	MICRONIC	
00001450.00	08/11/03	7088E	

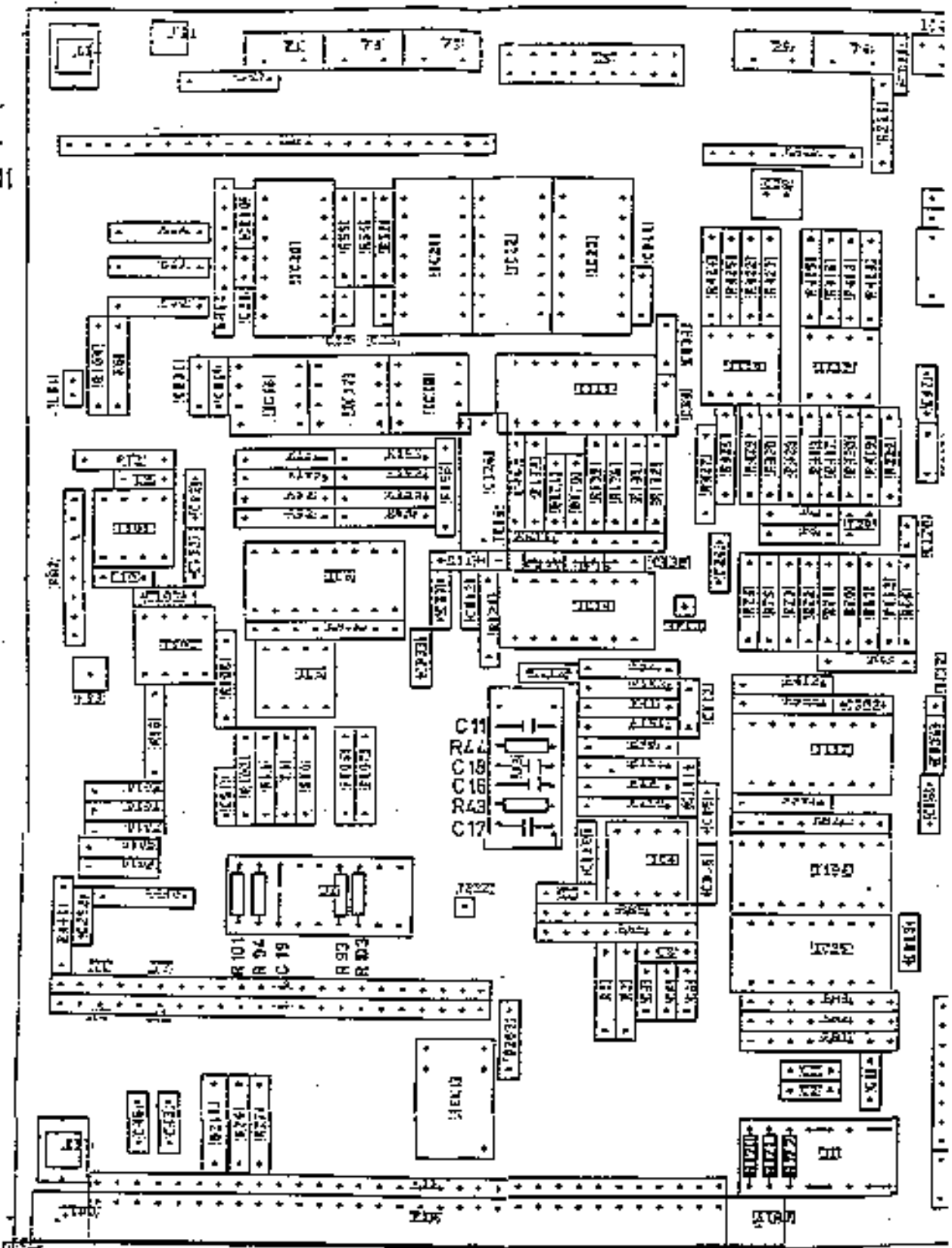
3000PC ART-4032 (A.12.20)
 No. of boards to be made up
 of this design is indicated in the
 quantity column. This quantity
 applies to the boards only and does not
 include the components listed in the
 parts list.
 Date: 11/11/83

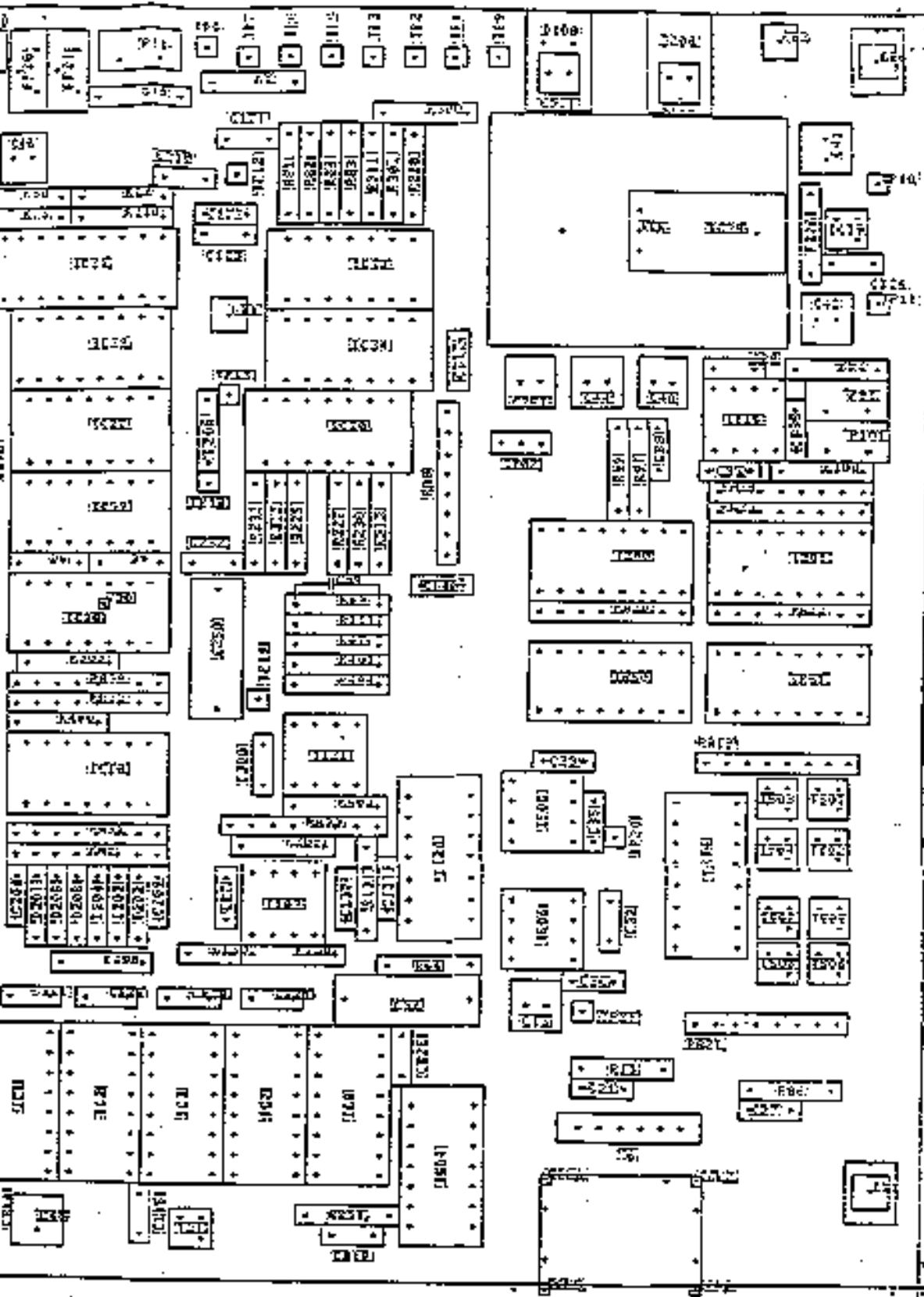
EXPLANATION
 PARTS LIST

THE SCHEMATIC OF BTS 10 RL
 VELOCITY CONTR. / VARIABLE COMP

17908 A BALDOR A S R

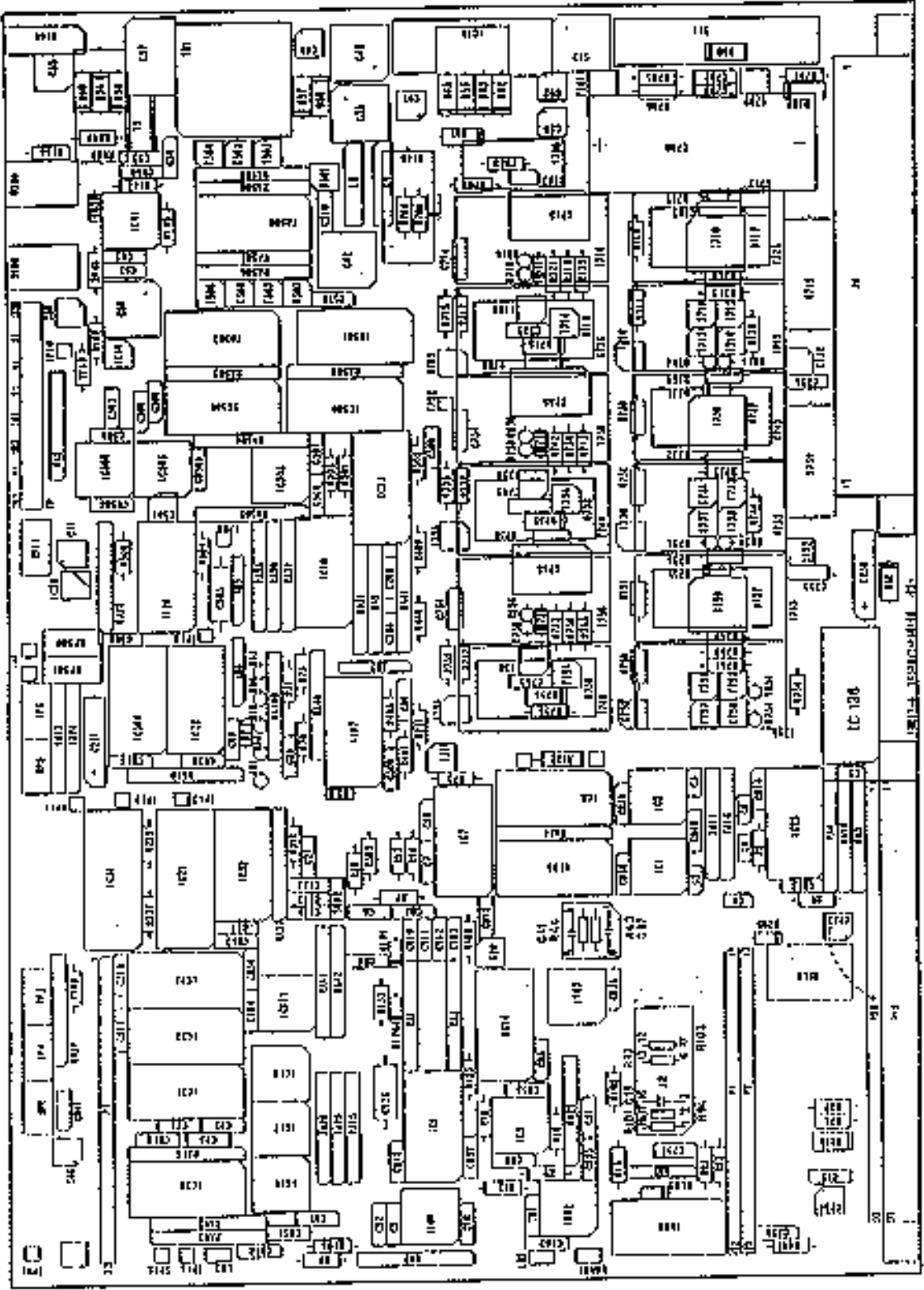
STAND: 175.88 ft
5.7.88 ft
29.9.88 Ml



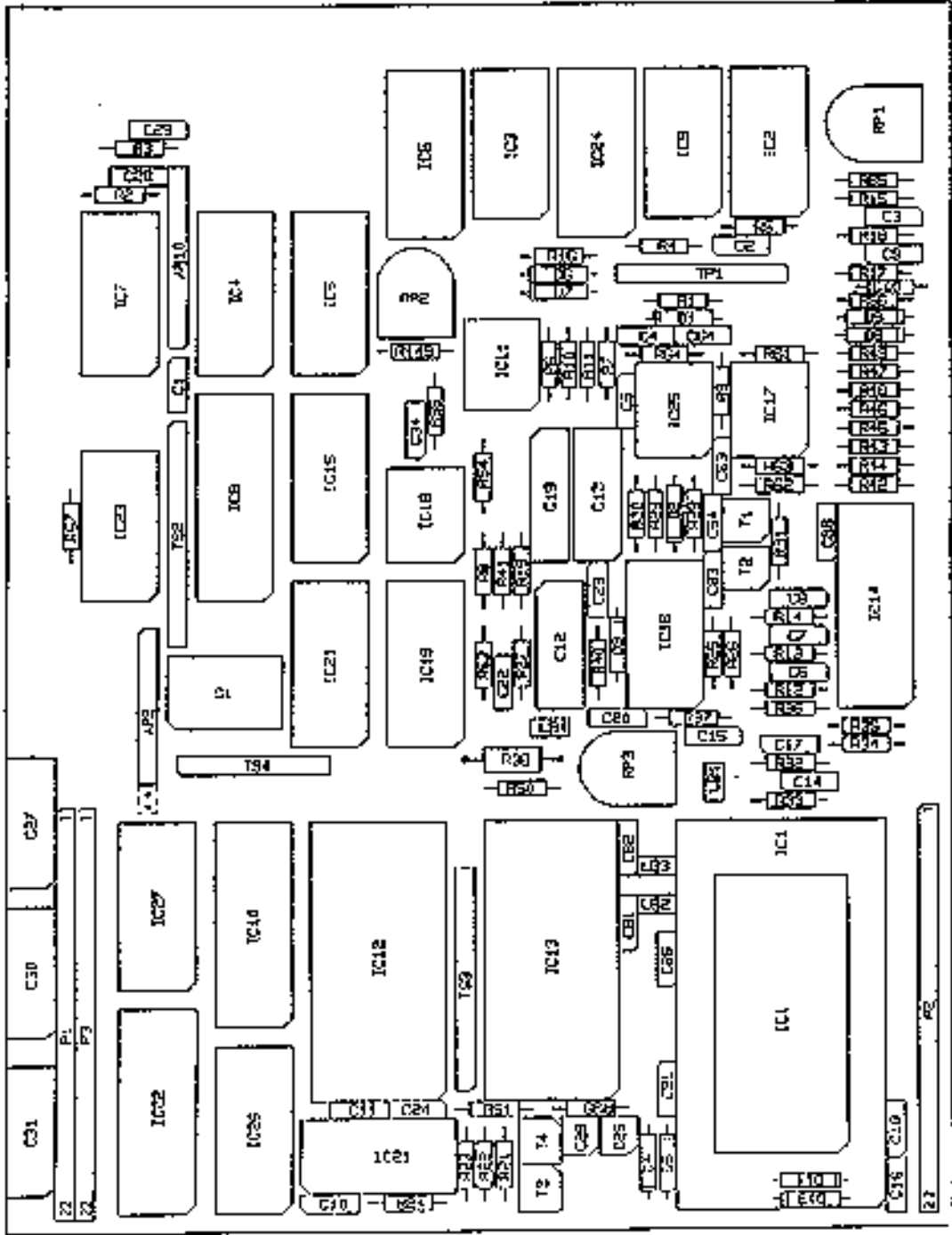


P5 SOLDER SIDE
 FOR TR44,50,51
 CUT PINS 1MM
 SHORTER

SURFACE ROUGHNESS		TOLERANCES		MATERIAL		PROTECTIVE FINISH	
TITLE BTS 10/1 CONTROL CARD COMPONENT LAYOUT				SCALE		DRAW. NO. 13809 C	
1966	DATE	NAME	REV. NO.	PROPRIETARY NOTICE SALTER This document contains proprietary information of SALTER.			



PROJECT NO: 17531B DATE: 11/10/81 DRAWN BY: [Name] CHECKED BY: [Name]	PROJECT NAME: BIS 10RL COMPONENT LAYOUT	SCALE: 1/4" = 1'-0"	DRAWING NO: 17531B PROJECT: RAJDOOR ASR
--	---	---------------------	--



STAND: 23.12.88 *ML*
 STAND: 17.01.89 *MI*
 TO: 5.89 *ML*
 26. 5.89 *ML*

NOTE: ACTUAL COMPONENT PLACEMENT
 MAY DIFFER FROM SHOWN
 COMPONENT LAYOUT
 R 38 ON SOLDER POINT

SURFACE MOUNTABLE		TELEPHONE		W/TELEPH		PROTECTIVE FILM	
VIA		BTS 10720 P-10R		BOARD		16070 B	
CARD 3		COMPONENT LAYOUT		DATE		REV. NO.	
DATE	BY	DATE	BY	DATE	BY	DATE	BY
1989-03-28	SEND	1989-03-28	B				
DRIVER		DRIVER		DRIVER		DRIVER	
NAME		NAME		NAME		NAME	

BALDWIN *ARM*

BPS 10-200-R

POWER SUPPLY FOR BTS 10 R/RL SERIES AMPLIFIERS

Together with an external 3-phase isolation-transformer the BPS 10 R represents the 200 V DC power-supply. Its function besides fullwave rectification and filtering also includes a power shunt or regeneration. The regeneration circuitry limits the DC-Bus voltage level during deceleration of the motor with its load thus preventing an over-voltage shut down on the BTS 10 R/RL. On the frontplate there are two indicators, one for the 200 V DC supply, the other for the activity of the regeneration.

Input for 200 V DC output: 3 x 140 V AC nominal

Regeneration level: 275 V DC (Pl set and sealed ex works)

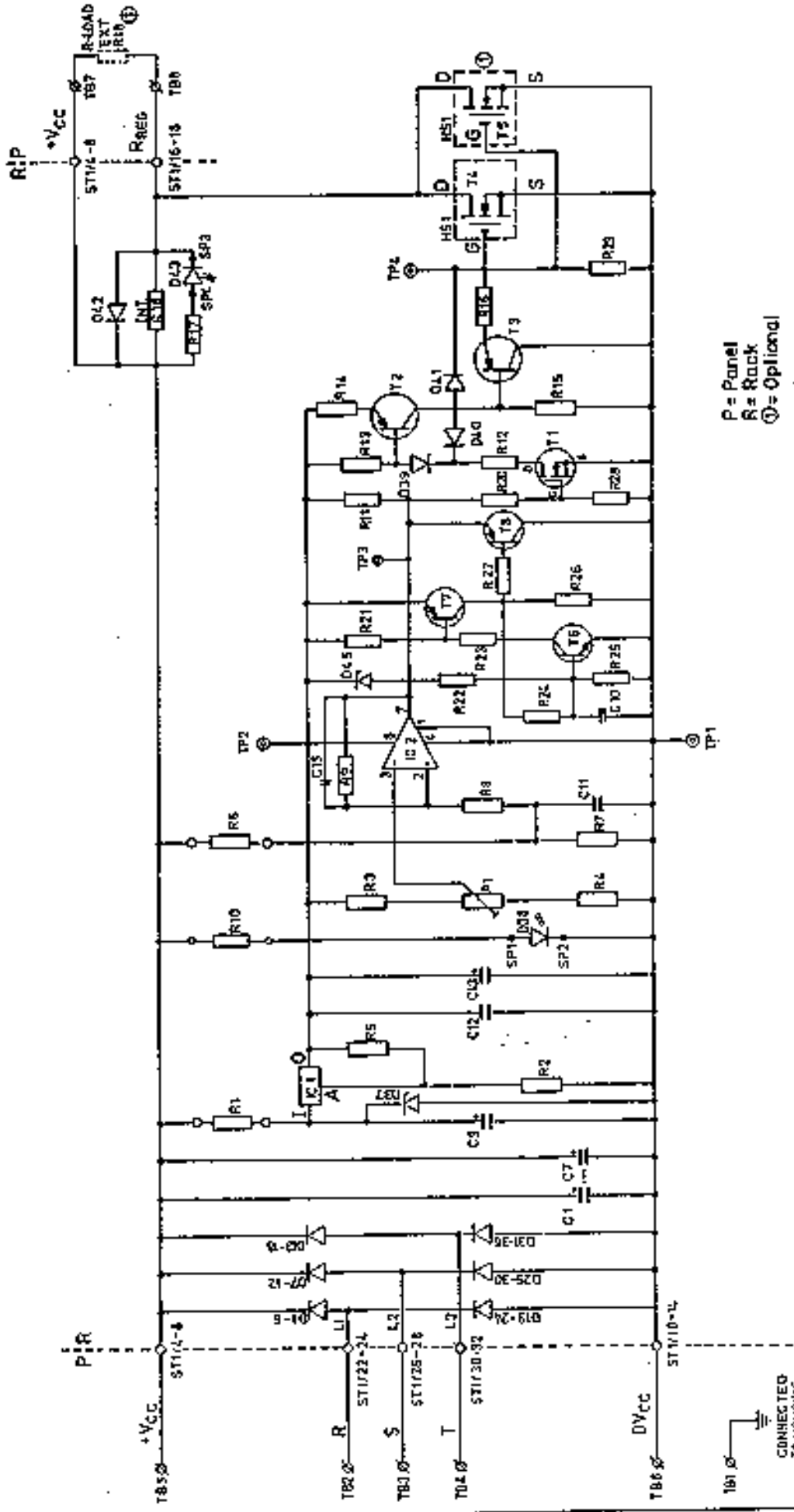
Loadresistors:

For all BPS 10 R versions an internal loadresistor with 80 W continuous powerrating is included. The peak power dissipation should not exceed 4 kW for time intervals shorter than 1 sec.

For applications where higher powerratings are needed an external resistor may be connected to ST 17 (+ Vcc/R REG), in this case the internal resistor (R18) has to be removed.

External resistors are available with 320 W powerrating (16 kW @ \leq 1 sec).

Note: The switching current (20 A) may not be increased, hence the resistor value must be \geq 14 Ω .



P = Panel
R = Rack
Ⓞ = Optional

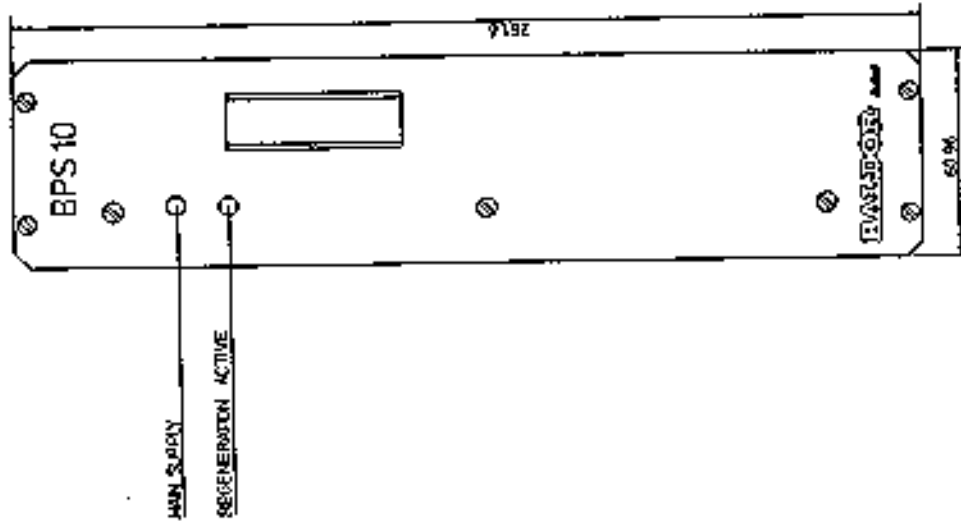
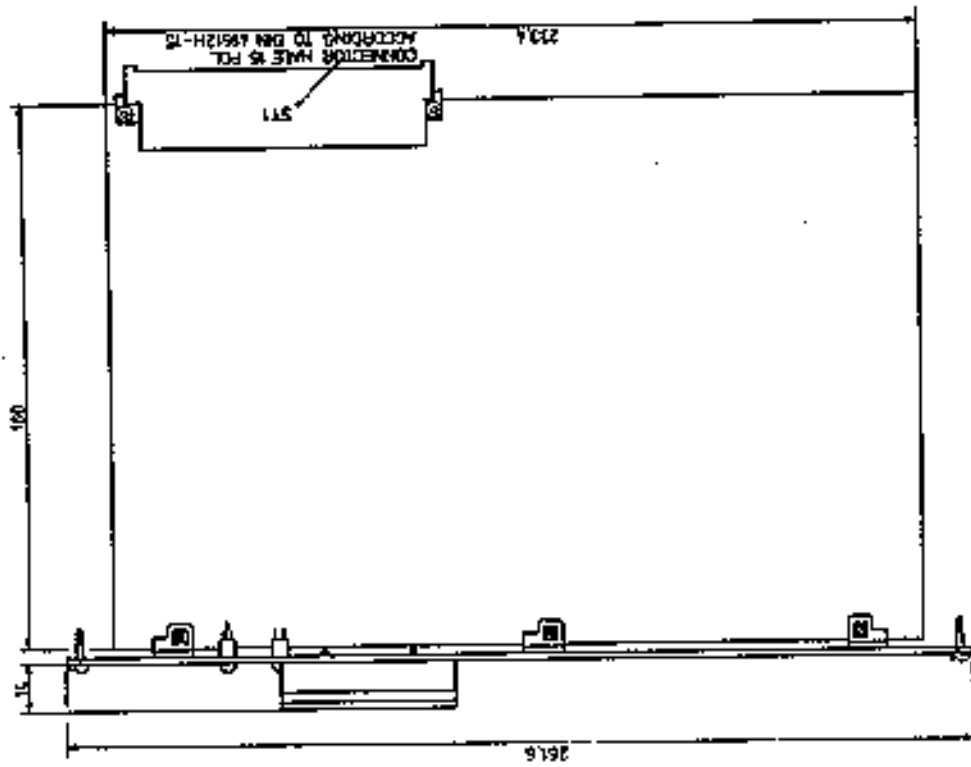
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AFF DRAWING NO. _____
DRAWING NUMBER 16180 B

TITLE
BPS 10 R/P
POWER SUPPLY
CIRCUIT DIAGRAM

ALL INFORMATION CONTAINED HEREIN IS UNCLASSIFIED EXCEPT WHERE SHOWN OTHERWISE.
DATE OF DECLASSIFICATION: 12/15/2011
BY: 60322 UCBAW/STP

DATE	BY	DESCRIPTION

14400B



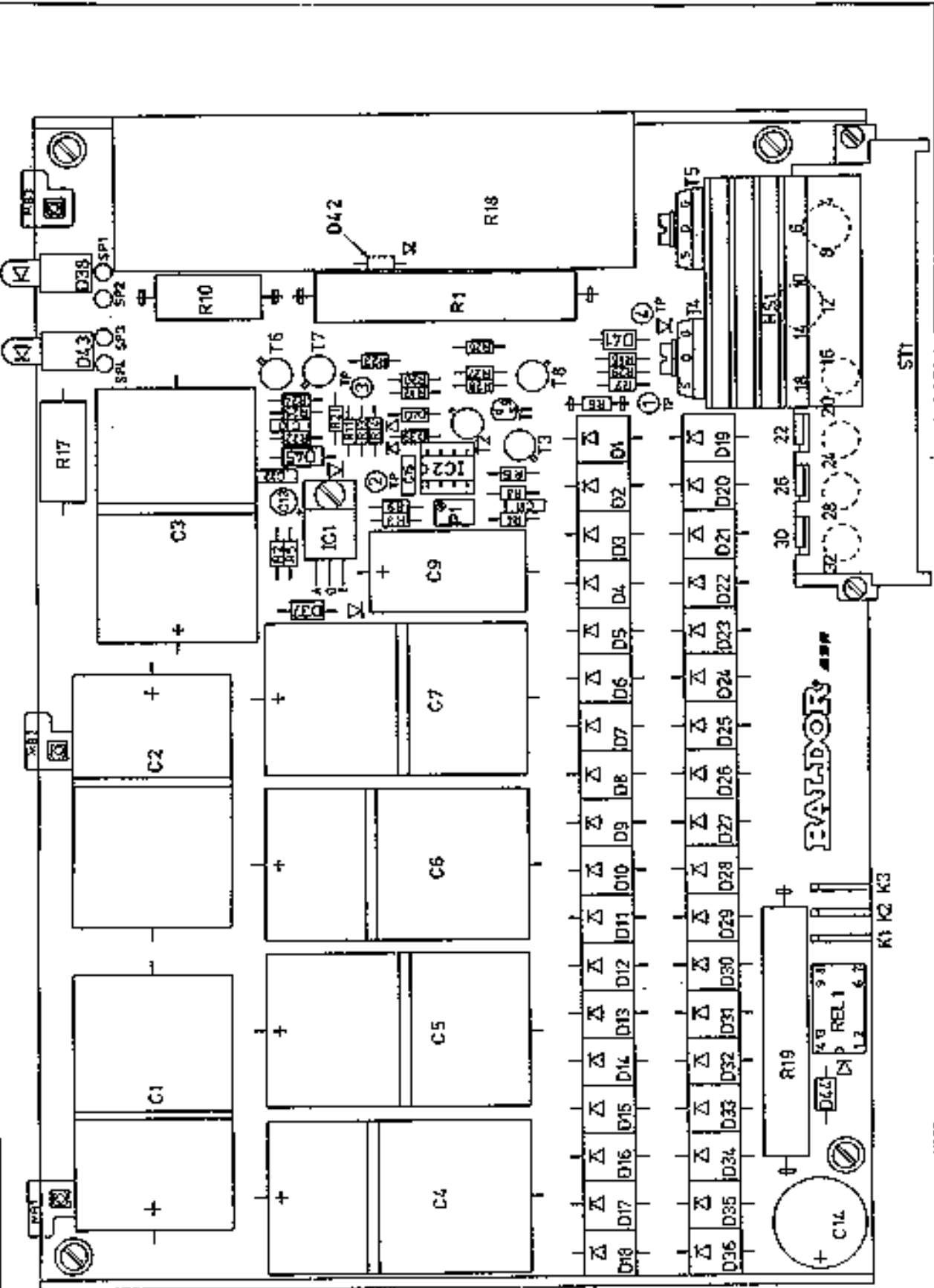
BPS 10
FRONT PANEL
MOUNTING DETAILS TO PCB

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14400B

BALFOUR
A.S.B. SERVICE

14476G



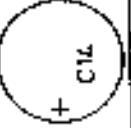
BALDOR	
Part No.	14476G
Rev.	2:1
BPS 10, 10B, 10R POWER SUPPLY COMPONENT OVERLAY	
DATE	11/10/58
BY	W.L.
CHECKED	W.L.
APPROVED	W.L.

NOTE:
 1. M51 IS MOUNTED ON SPACERS
 2. COMPONENTS SHOWN THIS WAY ARE MOUNTED ON SOLDER STUDS.
 3. ON BPS 10R, D36 IS MOUNTED ON A SEPARATE PCB ATTACHED TO THE HOUSING FRONT WALL. IT IS WIRED BACK TO THERE RESPECTIVE SOLDER POINT ON THE POWER SUPPLY BOARD

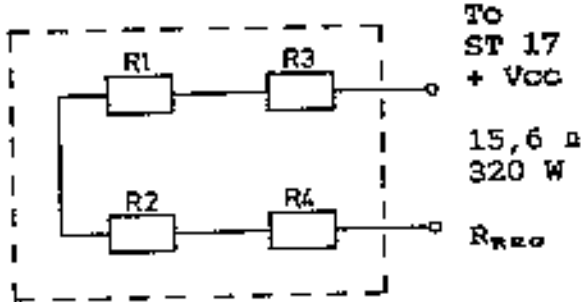
BALDOR

ST1

K1 K2 K3

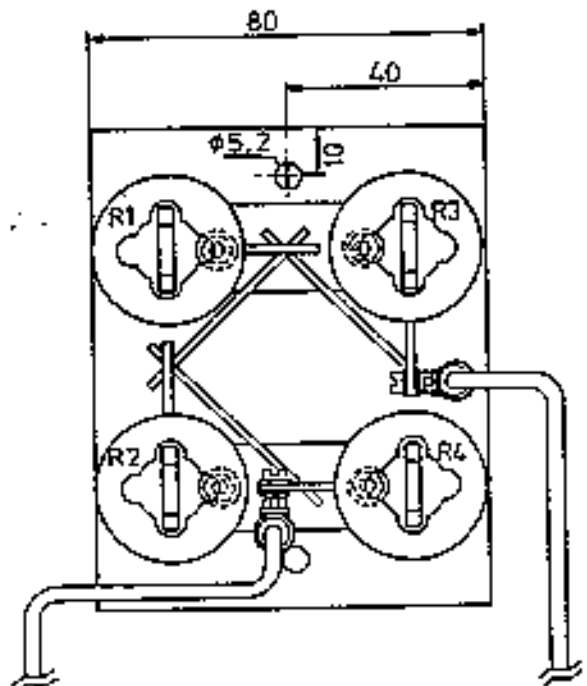
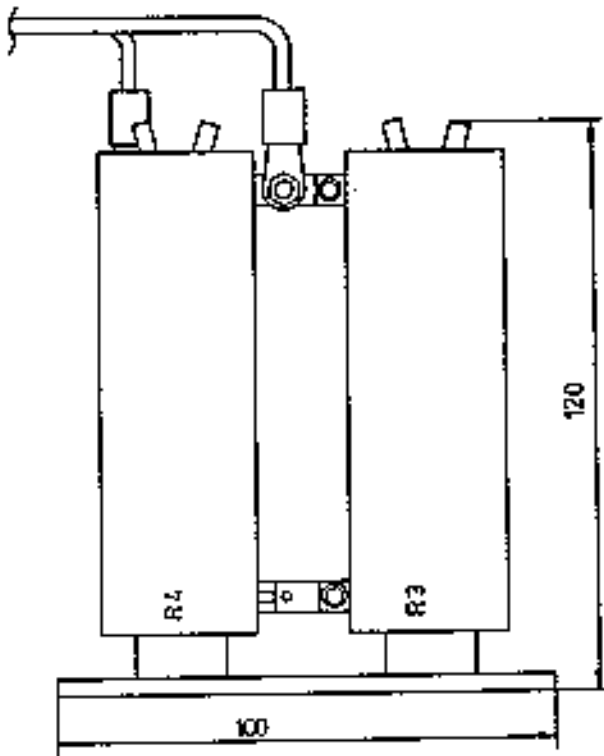


BPS 10 R-EXTERNAL LOAD RESISTOR



R 1...4 = 3,9 Ω/80 W
I_{SWITCH} = 17,5 A
14352A

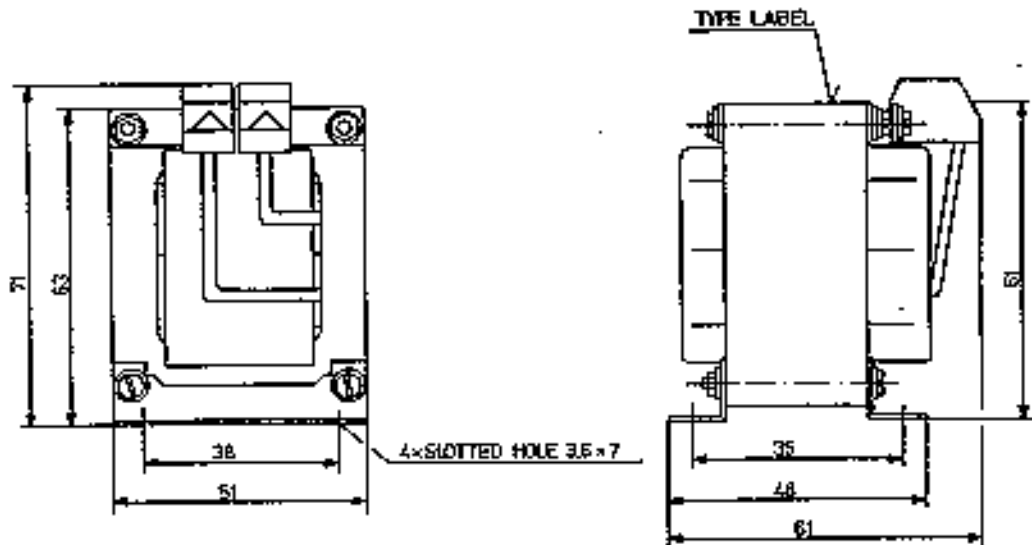
ASSEMBLY DRAWING AND DIMENSIONS



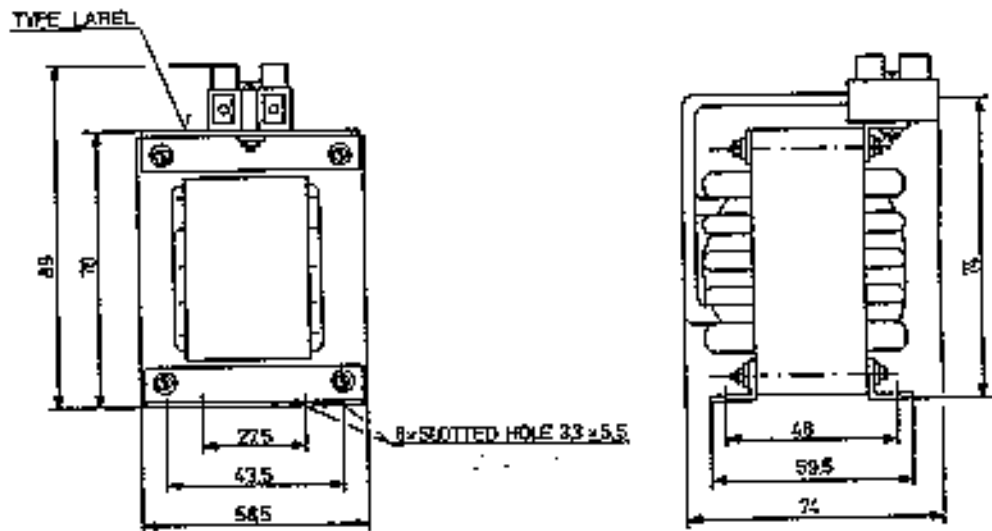
BTS 10 R/RL - PROTECTION CHOKES

The following chokes are available to protect the amplifier against shorts between the outputs and to ground. One choke in each of the three phases to the motor is needed for full protection.

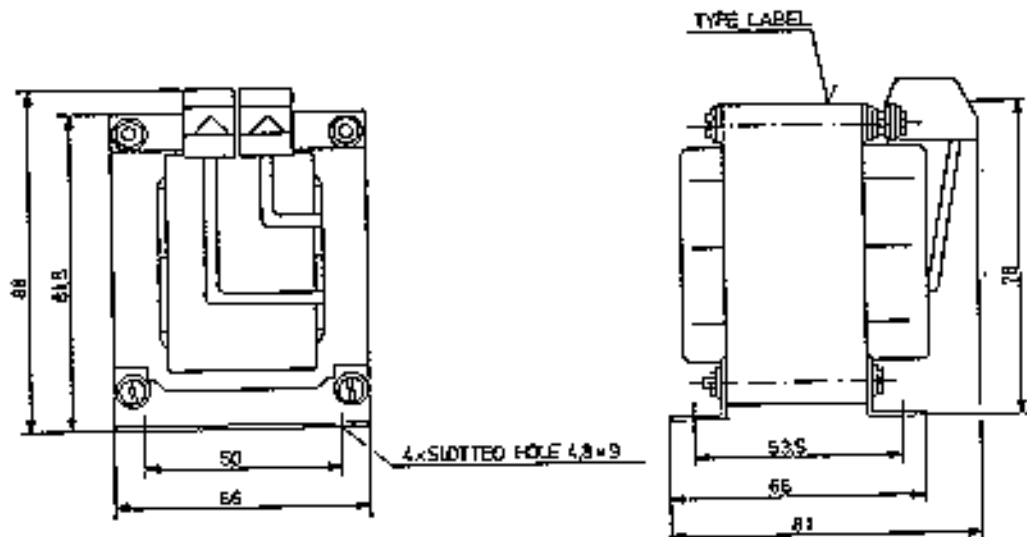
L 100-6
15528A
1 mH/5 A



L 040-15
12956A
400 μH/15 A

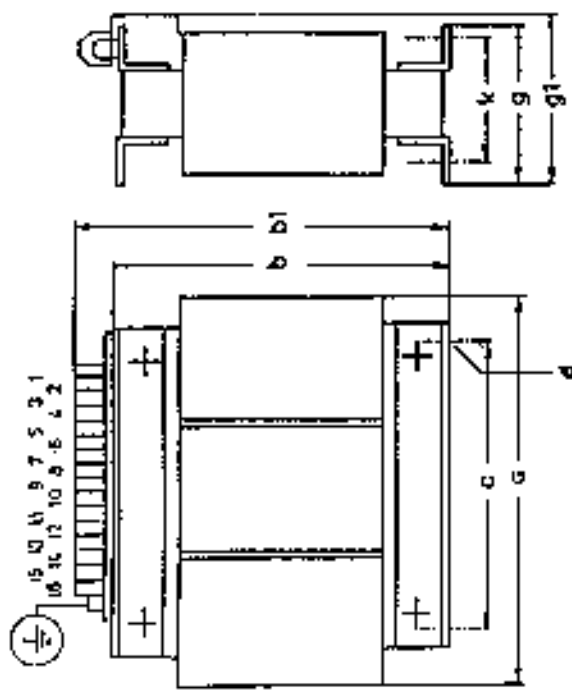


L 040-20
15527A
400 μH/20 A



Designation: DT-010 - 200 - 380 / -10% / ...
 DC Voltage x 100 = P[VA]

REVISONS	
DATE	APPROVED



TYPE	o _{max}	b _{max}	d _{max}	c	g _{max}	k	p	kg _{max}
DT 010-200	270	185	241	140	115	95	8.8	15
DT 025-200	264	230	285	200	120	90	10	27
DT 050-200	300	260	315	224	147	119	10	42
DT 075-200	360	310	372	264	150	140	10	66
DT 100-200	360	310	372	264	173	155	10	76
DT 150-200	420	360	422	315	203	173	12	116
DT 200-200	480	380	445	360	232	172	13	117
DT 250-200	480	380	445	380	232	172	13	126
DT 300-200	570	430	515	380	239	179	13	150



Wiring:
 1st primary V₁ 380V Standard
 R = 7 1 5
 S = 8 2 11
 T = 9 3 6

2nd primary V₂
 R = 10 1 12
 S = 11 2 9
 T = 12 3 6

Sec. (Star)
 U 13 } 14.3V-@no load
 V 14 }
 W 15 }
 Sec. 16

Notes: 1) Instead of 1+2+3, 4+5+6 may be jumpered to obtain 10% higher secondary.
 2) Optional on request.

<p>15.03.88</p> <p>59-5-11</p> <p>M</p>	<p>REVISIONS</p> <p>DATE</p> <p>APPROVED</p>	<p>PROPRIETARY NOTICE</p> <p>THIS DRAWING IS THE PROPERTY OF THE COMPANY AND IS NOT TO BE REPRODUCED OR USED IN ANY MANNER WITHOUT THE WRITTEN PERMISSION OF THE COMPANY.</p>
<p>15.03.88</p>	<p>150 75 B</p>	<p>REF. DRAWING NO.</p> <p>DRAWING NUMBER 150 75 B</p>

USER NOTES

1. 24 V-Option

The Control Supplies are normally generated from the 200 V_{DC} - BUS supply.

For some applications it is necessary to keep the control electronics on stand-by (ex. position information).

This can be achieved by using a supplementary external 24 V supply. In this case the internal supplies will be generated from the 24 V.

Consequently the BUS supply can be varied in a wide range from 0 to nominal.

This feature is not standard and cannot be fitted in the field.

2. S-Option

With a few changes it is possible to upgrade the BTS 10 R/RL to a S-BTS 10 R/RL.

- Remove resolver card.
- Remove frontplate.
- Cut out pin 12 of connector P4.
- Insert μ SMCC (S-Option).
- Install S-BTS 10 R/RL frontplate (available as spare part).

3. Current Offset Adjust (BTS 10 R only)

The current offsets are adjusted ex factory at an ambient temperature of 25° C.

At higher ambient temperatures a significant DC-component may be introduced in the motor windings due to thermal drift causing additional torque ripple.

Adjustment procedure:

- Remove BTS frontplate, insert amplifier in rack.
- Connect ST 4/2 (1 : 1) to DGND.
- Remove wiring to ST 6/3 and ST 6/4.
- Power on (amplifier enabled).
- Check TP5 with DVM to be 0 Volt.
- Connect DVM to TP1 (see page 16) and TP8 (GND).
- Adjust RP20 (see page 16) until $V_{TP1} = 0,0 V_{DC}$.
- Connect DVM to TP2 and adjust to Zero with RP21.
- Check TP3 = 0,0 V_{DC}.
- End.

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