CASWELL STREET PUMP STATION

MAINTENANCE AND INSTRUCTION MANUAL

KENNEDY-TAYLOR

ELECTRICAL ENGINEERING GROUP

A MEMBER OF ECTEC LIMITED GROUP

SYDNEY. MELBOURNE. BRISBANE. CANBERRA. CAIRNS. TOWNSVILLE. GOLD COAST. LATROBE VALLEY

CASWELL STREET PUMP STATION
MAINTENANCE AND INSTRUCTION MANUAL

INDEX

ELECTRICAL CONTRACTOR

KENNEDY TAYLOR (QLD) PTY LTD
562 CURTIN AVENUE
EAGLE FARM QLD 4001
TELEPHONE: (07) 268 1082 (All Hours)
FAX: (07) 268 4121

A

INDEX A4

marbig

Ref. No. 35050

made in germany

SECTION A

B

SECTION B

MAINTENANCE PROGRAM

MAINTENANCE PROGRAM

The Main Switchboard will be subject to many varying conditions during their service life. For this reason it will be necessary to conduct maintenance procedures to ensure the reliability of this equipment.

Listed below is a brief list of major items that require regular maintenance to ensure the correct operation.

1. FUJI FRN 200 P7-4 210KW VARIABLE FREQUENCY DRIVE
2. FUSE SWITCHES
3. CIRCUIT BREAKER
4. CONTACTORS
5. CONTROL SELECTORS
6. FUSES
7. INDICATOR LIGHTS
8. MONITORING & STATUS UNIT

Other items such as control relays, timers, transducers do not have recommended regular maintenance programme by the suppliers. To ensure that these items function correctly, it is recommended that the whole electrical system be put into full functional test every 12 months and this will ensure that these items will function correctly.

SECTION 1 FUJI FRN 200P7-4 210 KW VARIABLE FREQUENCY DRIVE
Please refer to section D Chapter 9 of this manual for Manufactures recommended Maintenance Program.

SECTION 2 FUSE SWITCHES
These items of equipment also require minimal maintenance after the initial connection and cleaning. Once again it is recommended that a functional switching operation be performed once every 12 months. The unit should be opened to check if the correct fuse cartridges are fitted.

SECTION 3 CIRCUIT BREAKER
This item of equipment also requires minimal maintenance after the initial connection and cleaning. Once again it is recommended that a functional switching operation be performed once every 12 months.

SECTION 4 CONTACTORS

The contactors fitted to this board are of high robust design for a reliable operation. It is recommended that every 12 months the coil be removed and magnet surfaces be inspected and cleaned if necessary.

SECTION 5 CONTROL SELECTORS

The control selectors fitted to this board are of high quality and are extremely reliable. However to ensure proper operation of these items it is recommended a functional switching test be performed every 12 months.

SECTION 6 FUSES

It should be verified that fuse connections are tight and that the rating of fuses is correct.

SECTION 7 INDICATING LIGHTS

Indicating light s fitted to these control panels are of high quality manufacture and maintain a long lamp life out put under normal service conditions. To ensure a prolonged lamp life, it is necessary that the control voltage does not exceed 6% it's normal voltage. Any excessive overvoltage shall rapidly diminish the lamp life of the indicators.

SECTION 8 CONTROL & STATUS MONITORING UNIT

Please refer to Section U Chapter 8 of this manual for Manufactures recommended maintenance program.

BUSBAR SECTION AND JOINTS

Busbars and busbar chambers and busbar supports should be examined as is necessary practicable as noted in the following comments.
-The examination should include any dismantling required to enable connections to be inspected and any chambers cleaned.
-The examination should include a visual verification of all joints for signs of overheating or loose fixing bolts.
- All fixing bolts should be retorqued to ensure maximum efficiency of the busbar joint. Listed below are recommended torque settings for the fixing bolts used in the switchboard.

M8 - 22Nm
M10 - 44Nm
M12 - 77Nm

Cable terminations should be inspected for loose or overheated joints and remedied as necessary.

SWITCHBOARDS & DISTRIBUTION BOARDS

Switchboards should be examined internally & externally every 12 months.

- The internal examination should include removal of any internal covers to enable all connections to be inspected & chambers cleaned. All connections should be checked to ensure they are tightened to recommended torque settings.

- The external examination should include.
  - -Corrosion.
  - -Check seem welds.
  - -Chipped paint.
  - -Build up of dust & grime.
  - -Clean & polish as required.

C

SECTION C

TEST REPORTS

KENNEDY - TAYLOR

SWITCHBOARD TEST REPORT

CLIENTS NAME: Kennedy's Taylor Services
PROJECT: Caswell St Pump Station
SW.BD. NAME: M.C.C. JOB NO: Q2/B/02
CONSTRUCTED BY: J. Hunter TESTED BY: [signature] DATE: 22/4/93

INSULATION TEST 1000 1000

DESIGNATION	1000 VOLT MEGGER	2.5 K.V. HI-POT FOR	1000 VOLT MEGGER	COMMENTS
R+W	60 MΩ	60 SEC OK	60 MΩ	
R - B	40 MΩ	60 SEC OK	40 MΩ	
W - B	60 MΩ	60 SEC OK	60 MΩ	
R+W+B - E+N	10 MΩ	60 SEC OK	10 MΩ	

MAIN SW'S	QUANT	✓	SIZE	✓						
C.F.S. UNITS	"		"		FUSES					
FUSE FITTINGS	"	✓	"	✓	"	✓				
CIRC. BREAKERS	"	✓	"	✓						
NEUT. & EARTH	"	✓	"	✓	NUMBERED	✓	ACCESS	✓	M.E.N.	✓
C.T.'s	"	✓	RATIO	✓	WIRING	✓				
METERS	"	✓	SCALING	✓						
CONTACTORS	"	✓	SIZE	✓	VOLTAGE	✓				
OVERLOADS	"	✓	"	✓	RESET		MAN	✓	AUTO	
RELAYS	"	✓	"	✓	VOLTAGE	✓				
TIMERS	"		RANGE		"					
CONTROL SW's	"	✓	SIZE	✓	ENGRAV.	✓	EARTHED			
PUSH BUTTONS	"		COLOUR		"		"			
PILOT LIGHTS	"	✓	"	✓	"	✓	"		VOLTAGE	✓
TRANSFORMERS	"	✓	RATING	✓	"		"		"	
AUTO TRANSF.	"		"		CONNECTIONS				PROTECTION	
TERMINALS	"	✓	SIZE	✓	TYPE	✓	NUMBERED			
ENGRAVING	FACIA		LABELS		SCREWED		GLUED			
CABLING	SIZE	✓	INSULATION	✓						
BUS BARS	"	✓	SUPPORTS	✓	CLEARANCE	✓	JOINTS	✓	PLATED	
ESCUTCHEONS	PVC		BAKELITE		METAL		POT. KNOBS		D-HANDLES	
S.A. METERING	C.T.		DIRECT		WIRING					

KT LABEL Yes SCHED. HOLDER Yes DWG. POCKET No SPARES No
WEATHER PROOF No DUST PROOF Yes PLINTH Yes LIFTING Bottom KEYS
COMMENTS ON FINAL FINISH - EXTERNAL OK
INTERNAL OK

EQUIPMENT MISSING

LIST OF LOOSE EQUIPMENT WITH S/BOARD
MESH COVER FOR OPENINGS IN TOP OF S/BOARD.

KENNEDY - TAYLOR (SERVICE) SHEET 1 OF 2.
Q3/B/02.

CASWELL ST MAIN S/BOARD

MICRO OHM TEST TAKEN AT SITE 7/10/93.

JOINT Nº.	POSITION OF JOINS.	RED	WHITE	BLUE
1	MAIN BUS TO DROPPER BARS	3	4	2
2	MAIN BUS TAKE OFF TO Nº3	2	2	3
3	ABOVE CT.	4	3	3
4	BELOW CT.	2	-	2
5	C/BREAKER CONNECTION. INCOMER 3.	2	2	3
6	THROUGH C/BREAKER INCOMER Nº3	17	19	18
7	LINE SIDE C/BREAKER Nº3	1	-	1
8	CABLE CONNECTIONS.	5	5	3
9	JOIN AT SPLIT IN BOARD	2	2	3
10	BOTTOM VERTICAL BARS.	2	2	2
11	JOIN ON HORIZON. BARS	2	3	2
12	BOTTOM OF BUS-TIE	2	3	2
13	TOP OF BUS-TIE	2	3	2
14	CONNECTION TO HORIZONTAL BARS	3	2	2
15	DROPPERS TO INCOMER Nº2 C/B	2	2	2
16	ABOVE CT'S	5	2	3
17	BELOW CT.	3	-	3
18	TOP OF INCOMER Nº2 C/BREAKER	2	2	3
19	THROUGH C/BREAKER INCOMER Nº2.	8	12	9.
20.	BOTTOM OF C/BREAKER NO 2	2	-	2
21	CABLE CONNECTIONS	6	6	3.
22	DROPPERS TO INCOMER Nº1	2	2	3
23	ABOVE CT'S	2	1	1

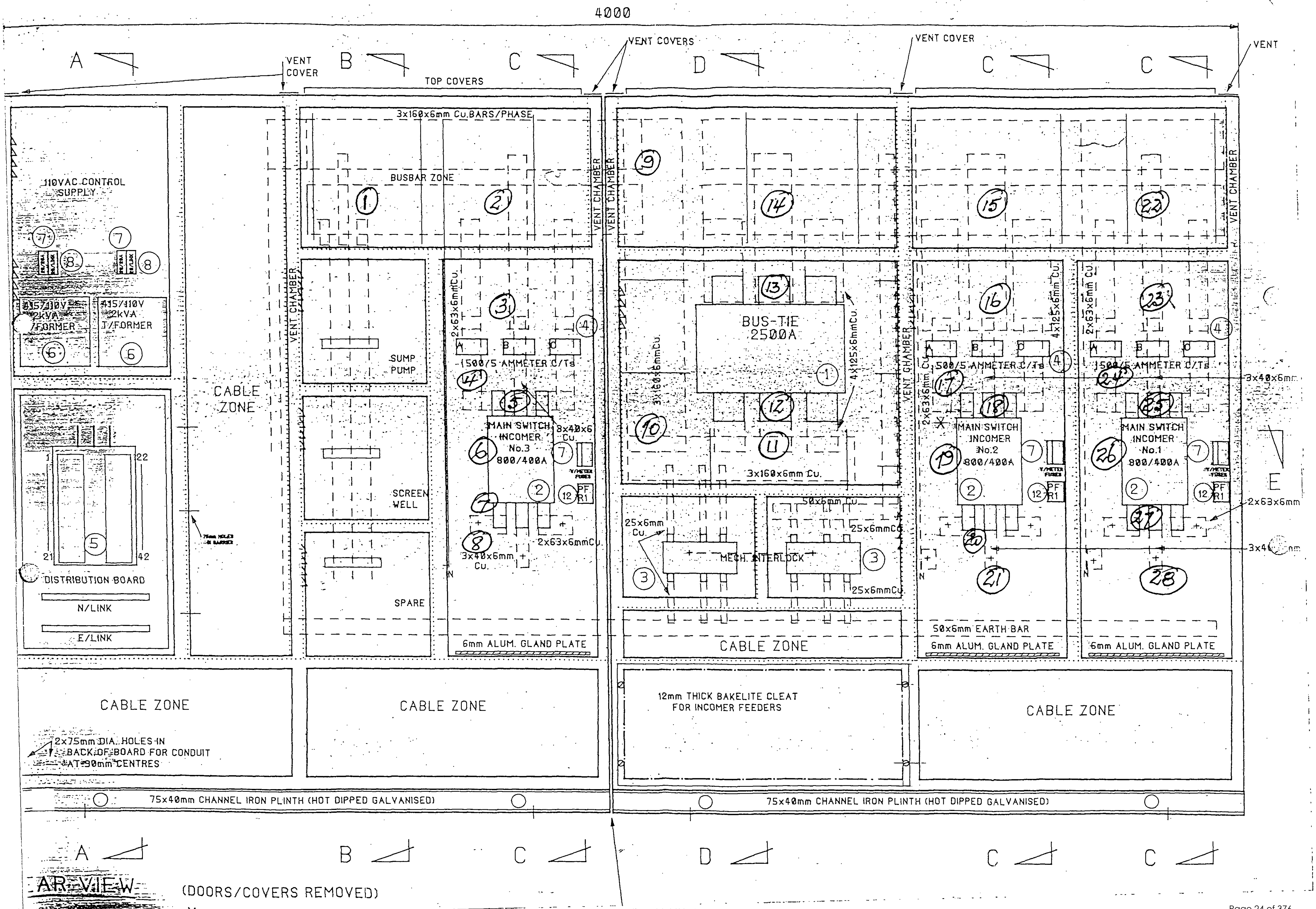
CASWELL ST MAIN S/BOARD SHEET 2 OF 2

MICRO OHM TEST TAKEN AT SITE 7/10/93
(CONTINUED)

JOINT Nº	POSITION OF JOIN.	RED	WHITE	BLUE
24	BELOW CT'S.	2	-	2
25	TOP OF INCOMER Nº1	2	1	3
26	THROUGH C/BREAKER INCOMER NO1	9	8	9
27	BOTTOM OF INCOMER Nº1	1	1	3
28	CABLE CONNECTIONS.	3	3	4
29	MAIN BARS TO PUMP Nº1	5	5	4
30	TOP OF C/BREAKER PUMP N.O1	2	2	2
31	MAIN BARS TO PUMP Nº2	1	2	2
32	TOP OF C/BREAKER PUMP Nº2	2	4	3
33	MAIN BARS TO PUMP Nº3	2	2	2
34	TOP OF C/BREAKER PUMP Nº3	1	1	2
35	BOTTOM OF PUMP Nº1 C/BREAKER	3	4	3
36	TO GROUND FAULT RELAY	2	2	2
37	BOTTOM OF PUMP Nº2 C/BREAKER	4	5	4
38	TO GROUND FAULT RELAY	3	2	3
39	BOTTOM OF PUMP NO 3 C/BREAKER	4	4	4
40	TO GROUND FAULT RELAY	3	3	2
41	Nº1 CABLE CONNECTIONS BOTTOM CONT	7	8	5
42	Nº2 CABLE CONNECTIONS BOTTOM CONT	5	7	5
43	Nº3 CABLE CONNECTIONS BOTTOM CONT	6	6	5

ALL ABOVE READINGS IN MICRO OHM'S.

Baker


4000
VENT COVER
VENT COVERS
VENT COVER
VENT
TOP COVERS
3x160x6mm Cu.BARS/PHASE
BUSBAR ZONE
110VAC CONTROL SUPPLY
415/110V 2kVA T/FORMER
415/110V 2kVA T/FORMER
VENT CHAMBER
CABLE ZONE
SUMP PUMP
SCREEN WELL
SPARE
1500/5 AMMETER C/Ts
MAIN SWITCH INCOMER No.3 800/400A
MAIN SWITCH INCOMER No.2 800/400A
MAIN SWITCH INCOMER No.1 800/400A
BUS-TIE 2500A
3x160x6mm Cu.
MECH. INTERLOCK
50x6mm EARTH BAR
6mm ALUM. GLAND PLATE
DISTRIBUTION BOARD
N/LINK
E/LINK
CABLE ZONE
12mm THICK BAKELITE CLEAT FOR INCOMER FEEDERS
2x75mm DIA. HOLES IN BACK OF BOARD FOR CONDUIT AT 90mm CENTRES
75x40mm CHANNEL IRON PLINTH (HOT DIPPED GALVANISED)
AR VIEW
(DOORS/COVERS REMOVED)

FORM 4 (10/2/93) I.I.N. 2251

Part 1: Consumers Copy

SEQEB

FORM 4

Electricity Act 1976-1988 (Queensland) (S. 175)

Electricity Regulations 1989

ELECTRICAL CONTRACTOR'S REPORT TO THE CONSUMER

Use BLOCK LETTERS and indicate in appropriate boxes

DETAILS OF ELECTRICAL CONTRACTOR Responsible for the Actual Performance of the Electrical Installation Work

Name: KENNEDY - TAYLOR Licence No.: 263

NAME OF CONSUMER: BRISBANE CITY COUNCIL

Postal Address of Consumer:

Address where Electrical Work was Carried Out and Connected: CASWELL ST. SEWERAGE PUMPING STATION

DETAILS OF ELECTRICAL WORK THAT IS NOT REQUIRED TO BE INSPECTED BY AN INSTALLATION INSPECTOR AND THAT HAS BEEN TESTED AND CONNECTED

	Lighting		Power		Motors		Other Fixed Electrical Articles			
	No.	Watts	No.	Watts	No.	Watts	Type	Watts	Type	Watts
Details of Electrical Installation Work (Attach Schedule if required)					3	x 210 KW				
Details of Repairs (Attach Schedule if required)										

EXISTING LIGHTING AND POWER CIRCUITS TESTED PRIOR TO CONNECTION TO NEW MAIN S/BOARD

DEFECTS REPORTED BY AN INSTALLATION INSPECTOR AND REMEDIED BY THE ELECTRICAL CONTRACTOR

☐ Listed on Inspection Report (Form 2A):	Date of issue:	Details:
☐ Listed on Check Inspection Report (Form 3):	Date of issue:	Details:
C.I.R. Number:		

CERTIFICATE OF TEST AND CONNECTION

I certify that the electrical installation work listed above has been tested in accordance with the prescribed procedure and that such work complies in every respect with the requirements of the *Electricity Act 1976-1988* and has been connected to the source of supply.

Details of Electrical Contractor	Name: KENNEDY - TAYLOR	Details of Electrical Mechanic who tested and connected the electrical work listed above	Name: R. JAWORSKI	
	Address: P.O. BOX 161 HAMILTON CENTRAL		No. of Certificate of Competency: 4769	Date: 22-11-93
			Signature of Electrical Mechanic:	
Licence No.: 263	Phone No.: 2681082	Date: 22-11-93	Signature of Electrical Contractor or his Endorsee:	

SEQEB

FORM 2

Part 1: Consumers Copy

Electricity Act 1976-1989 (Queensland) (Ss. 159A, 175)
Electricity Regulations 1989
To: The South East Queensland Electricity Board

OTIFICATION OF METERING CHANGES NEEDED OR OF ELECTRICAL INSTALLATION WORK READY FOR INSPECTION

e BLOCK LETTERS and indicate in appropriate boxes.

AME CONSUMER:	BRISBANE CITY COUNCIL	Existing Meter Numbers (if applicable)
dress where spection is equired:	CASWELL ST. PUMPING STATION	
stal Address of onsumer and ephone Number:		
rections to Locate d Gain Access:	ELECT. ON SITE	Additional details may be placed on the back of this form

OFFICIAL USE ONLY		
Account No.	Application No.	
Date Notification Received:		
Pole/Pillar No.		
Meter No.	Tariff	Meter Mult.

ETAILS OF ELECTRICAL ONTRACTOR Responsible the Actual Performance the Electrical Installation ork	Name: KENNEDY TAYLOR
	Licence No.: 263

Work Ready for Inspection:
Date: 3-10-93 Time: 9.00 am/~~pm~~

SPECTION TYPE	Initial	☑ Permanent ☐ Temporary	☐ METERING CHANGES
☐ Hazardous Area	Classification of Area	☐ High Voltage	Equipment, Tariff Load or Other Details / Rating kW
☐ Authorised Electrical Mechanic: ame: R. JAWORSKI	No. of Certificate of Competency: 4769		MAINS + 3 SETS M.S.B.
ber of Phases: 3	Consumer's Mains Current Rating 400A		(Attach schedule if required)

ERTIFICATE OF TEST I certify that the electrical installation work listed above has been tested in accordance with the prescribed procedures and that such work complies in every respect with the requirements of the *Electricity Act 1976-1989* and * is now ready for inspection by an Installation Inspector * metering changes are needed (* Strike out whichever is not applicable)

etails ectrical ontractor	Name: KENNEDY TAYLOR	Details of Electrical Mechanic who tested the electrical work listed above	Name: R. JAWORSKI	
	Address: PO BOX 161 HAMILTON CENTRAL		No. of Certificate of Competency: 4769	Date: 29-9-93
			Signature of Electrical Mechanic:	[signature]
Licence No. 263	Phone No.: 2681082	Date: 29-9-93	Signature of Electrical Contractor or his Endorsee	[signature]

INSPECTION REPORT **FORM 2A** *Electricity Act 1976-1989* (Queensland) (S. 175)

Results of Inspection. This form can only be completed by an Installation Inspector.

Strike out sections not applicable.
~~Section I - The results of the inspection were satisfactory and the work is now connected to the source of supply.~~
Section II - Inspection of the electrical work revealed the following defects in the installation that has been connected to the source of supply. These defects are unlikely to cause fire or a person to sustain and electric shock and your Electrical Contractor has been advised that the installation does not comply in every respect with the Act and it is his responsibility to remedy such defects.

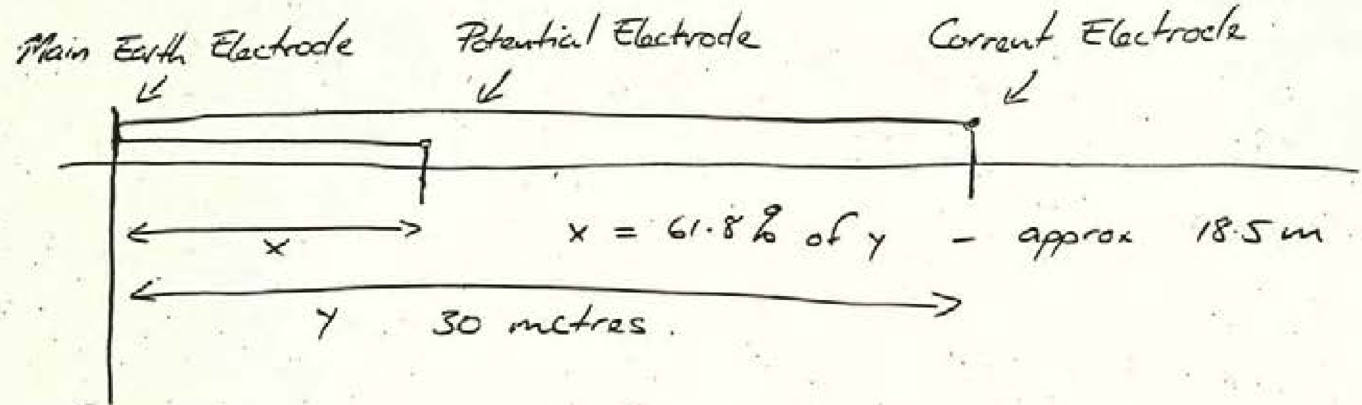
KTs
(1) M.E.N Location to be marked at the main switchboard C 2.23.5.
(2) Safety signs to be erected around and below the cascade platform where the 11KV transformers 1, 2, 3 are mounted C 8.11) BCC
(3) The combined earthing system is required to comply with C8.12.4.3
KTs

~~Section III - Inspection of the electrical work revealed the following defects that are likely to cause fire or that are likely to cause a person to sustain an electric shock and this work has not been connected to the source of supply. Your Electrical Contractor has been advised accordingly. These defects must be rectified before this work may be connected to the source of supply.~~

Caswell St Earthing 30/9/93

Earth Electrode Resistance Test

Method.



Western Electrode Test

Meter type DET3/2 Earth megger

Result 4.08 Ω to earth.

Eastern Electrode Test

Meter type DET3/2. Earth megger.

Result 3.94 Ω to earth.

Combined Electrode Test

Meter type DET3/2. Earth megger.

Result. 0.25 Ω to earth.

Rob Killick.

B.C.C.

Eagle Farm M+E.

CASWELL ST PUMP STATION ELECTRICAL INSTALLATION

MAIN SWITCHBOARD TEST SHEET

Origin	Inspection	Tests	Date	Cable Type	Cable No	Switchboard Megger Test Results	Destination Field Device	Tests	Name Plate Details	FLC	O/L Setting	Sign
						With Bustie Closed						
MS 1	Visual	I R	5/10			R - W 100M.ohms						
						W - B 100M.ohms						
						R - B 100M.ohms						
						R - N 80M.ohms						
						W - N 80M.ohms						
						B - N 30M.ohms						
						R - E 80M.ohms						
						W - E 80M.ohms						
						B - E 30M.ohms						
MS 2	Visual	I R	5/10			R - W 100M.ohms						
						W - B 100M.ohms						
						B - R 100M.ohms						
						R - N 80M.ohms						
						W - N 80M.ohms						
						B - N 30M.ohms						
						R - E 80M.ohms						
						W - E 80M.ohms						
						B - E 30M.ohms						
MS 3	Visual	I R	5/10			R - W 100M.ohms						
						W - B 100M.ohms						
						B - R 100M.ohms						
						R - N 80M.ohms						
						W - N 80M.ohms						
						B - N 30M.ohms						
						R - E 80M.ohms						
						W - E 80M.ohms						
						B - E 30M.ohms						

CASWELL ST PUMP STATION ELECTRICAL INSTALLATION

PARALLELLING TRANSFORMERS 1,2 & 3 TEST SHEET

Origin	Inspection	Tests O Sequence	Date	Cable Type	Cable No	Switchboard Meggar Test Results	Destination Field Device	Tests	Name Plate Details	FLC	O/L Setting	Sign
						With Bustie Open						
						TRANSFORMER Nos.1,2 AND 3 ENERGISED						
TX 1		Millivolts	5/10			B - B 100Millivolt						
on line		Volts				B - W 469 Volt						
and		Volts				B - R 463 Volt						
TX 2		Millivolts				W - W 122Millivolt						
to bus		Volts				R - W 464Volt						
		Millivolts				R - R 212Millivolt						
TX 2		Millivolt	5/10			B - B 181Millivolt						
on line		Volts				B - W 470 Volt						
and		Volts				B - R 465 Volt						
TX 3		Millivolt				W - W 258Millivolt						
to bus		Volts				R - W 464Volt						
		Millivolt				R - R 165Millivolt						

Note; All transformers were parallelled successfully 5/10/93

All HV CB tripped manually and racked down

CASWELL ST. PUMP STATION

TEST SHEET 26-10-93

INSULATION RESISTANCE

NO1. PUMP	R - E	= 100 M. OHM
	W - E	= 100 M. OHM
	B - E	= 100 M OHM
NO2 PUMP	R - E	= 100 M OHM
	W - E	= 100 M OHM
	B - E	= 100 M OHM
N-3 PUMP	R - E	= 100 M OHM
	W - E	= 100 M OHM
	B - E	= 100 M OHM

CASWELL ST PUMP STATION ELECTRICAL INSTALLATION

ELECTRICAL CABLING TEST SHEET

Origin	Inspection	Tests	Date	Cable Type	Cable No	Test Results	Destination	Tests	Name Plate Details	FLC	O/L Setting	Sign
							Field Device					
TX- 1	Visual	I.R.	4/10	S1	T1 - P1	R-W = >100 M.Ohm	MCC					
		Cont.				R-B = > 100M.Ohm	INCOMER					
						W-B = > 100m.Ohm	No.1					
						R-N = > 100M.Ohm						
						W-N = > 100M.Ohm						
						B-N = > 100M.Ohm						
						R-E = > 100M.Ohm						
						W-E = > 100M.Ohm						
						B-E = > 100M.Ohm						
						N-E = > 100M.Ohm						
TX- 2	Visual	I.R.	4/10	S1	T2 - P1	R-W = >100 M.Ohm	MCC					
		Cont.				R-B = > 100M.Ohm	INCOMER					
						W-B = > 100m.Ohm	No.2					
						R-N = > 100M.Ohm						
						W-N = > 100M.Ohm						
						B-N = > 100M.Ohm						
						R-E = > 100M.Ohm						
						W-E = > 100M.Ohm						
						B-E = > 100M.Ohm						
						N-E = > 100M.Ohm						
TX- 3	Visual	I.R.	4/10	S1	T3 - P1	R-W = >100 M.Ohm	MCC					
		Cont.				R-B = > 100M.Ohm	INCOMER					
						W-B = > 100m.Ohm	No.3					
						R-N = > 100M.Ohm						
						W-N = > 100M.Ohm						
						B-N = > 100M.Ohm						
						R-E = > 100M.Ohm						
						W-E = > 100M.Ohm						
						B-E = > 100M.Ohm						
						N-E = > 100M.Ohm						

D

SECTION D

VARIABLE FREQUENCY DRIVE

FUJI FRN 200 P7-4 210 KW

SUPPLIED BY: EMSBY EQUIPMENT PTY LTD
33 ACHIEVEMENT CRESENT
ACACIA RIDGE QLD 4110
TEL: (07) 274 2566
FAX: (07) 274 2387

FUJI ELECTRIC

FUJI INVERTER

FRENIC5000G7 · FRENIC5000P7

INSTRUCTION MANUAL

200V 30～90kW (G7 EXPORT SERIES)
30～110kW (P7 EXPORT SERIES)
400V 30～220kW (G7 EXPORT SERIES)
30～280kW (P7 EXPORT SERIES)

Fuji Electric Co.,Ltd. INR-HF 50321-E

Preface

Thank you for your purchase of Fuji Inverter FRENIC 5000G7/P7.
Please note that the proper use in accordance with this manual can ensure your expectation on performance, the incorrect handing will result in impr0per operation causing the reduced service life and damages. Therefore, be sure to read through this manual before the actual use. On the other hand, when the equipment incorporating this inverter is due to be shipped, you are requested to promptly supply this manual to your customers without fail.

Table of Contents

PRECAUTIONS

WARNING—HAZARD OF ELECTRICAL SHOCK:
Disconnect incoming power before working on this control.
All motor bases and inverter enclosure housings should be grounded in accordance with the electrical standard.

WARNING—HAZARD OF MOTOR OVERSPEED:
The maximum frequency is 400Hz, which is equivalent to 12000r/min of high speed rotation in 4-pole motor. The incorrect setting may result in a catastrophic failure for the machine.

CAUTION: Do not connect power supply voltage that exceeds the standard specification voltage permissible fluctuation. If excessive voltage is applied to the inverter, damage to the internal elements will result.

CAUTION: Do not connect power source to the output terminals (U, V, W).

CAUTION: If the (+)-(−) terminals are short-circuited or connected a braking resistor directly without a bracking unit, damage to the inverter will result. Do not fail to match the terminal symbols (+) and (−) between inverter and braking unit.

CAUTION: Do not connect AC power source voltage to the control circuit terminals (except for 30A, 30B, 30C, AX1, AX2).

CAUTION: Connect the inverter to a power source which capacity is less than 10 times of inverter capacity or 500kVA. If the power sourse capacity is larger than these, install a Line side AC reactor (ACR - - - option) on the line side of the inverter.

CAUTION: Do not connect a power factor correcting capacitor to the output side of the inverter.

CAUTION: If the inverter protective function is activated, consult Section 10 "Troubleshooting", and after correcting the problem, resume operation. Do not reset the alarm automatically by external sequence, etc.

CAUTION: Do not conduct megger tests between the inverter terminals or control circuit terminals.

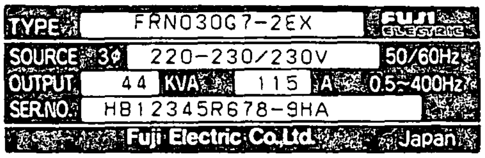
NOTE: This manual is described by using "SI unit". It might happen that the unit symbols of the product are different from the ones of this manual.

NOTE: The terminal symbols of DC intermediate circuit of product are reviced as follows.
P ⇨ (+), N ⇨ (−)
So, if the product's symbols are P or N, please connect the wiring so that "P" is for "(−)" and "N" is for "(−)".

1. Check after Delivery

After unpacking, perform the checking described as follows.

(1) Check the name plate on the cover to confirm that the product delivered is what you have ordered.



←Inverter type
←Rated input AC voltage / frequency
←Rated output current / output frequency range
←Manufacturer's serial number

Fig. 1-1 Name plate

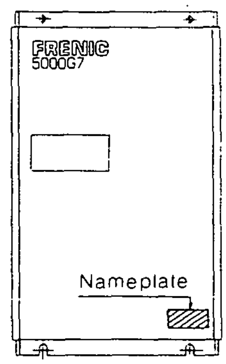


Fig. 1-2 Name plate position

Inverter type

FRN 030 G7 - 2 EX

- EX → Export series
- 2 → Power supply voltage: 2 → 200V type, 4 → 400V type
- G7 → Series name: G7 or P7
- 030 → Standard applicable motor output: 030 → 30kW, 220 → 220kW
- FRN → Product type: FRENIC5000

(2) Check that there should be no faults such as damages and detachment in the parts and concaves on the cover. If some have been found, the user is requested to promptly contact the supplier or the nearest Fuji sale office.

2. Carriage and Storage

In the case of carrying and temporary storing after the delivery, the following cautions should be taken.

2-1 Carriage

(1) For carrying, careful handing is required to avoid dropping, etc.
(2) Since carrying by means of holding the terminals or the top cover may result in damages and dropping, be sure to hold the body.
(3) The ambient temperature range at carrying (during transportation) should be within −25℃ ~ +65℃.

2-2 Storage

(1) Ambient temperature
The ambient temp. range in storage is within −25℃ ~ +65℃.
(2) Packing
No packing condition in storage, where the inverter is exposed to rust, dust and damage, is undersirable.
Packing is necessary in storage.
(3) Place
Avoid leaving the inverter directly on such as the concrete floor and put it on a rack. Avoid also the place which gets the sun light.
(4) Humidity
Don't storage in humid environments.
(5) Corrosive gases
Don't storage in the atomosphere which contains corrosive gases such as sulfurized gas, ammonia gas, and chlorine gas.

2-3 Neglect after Installation

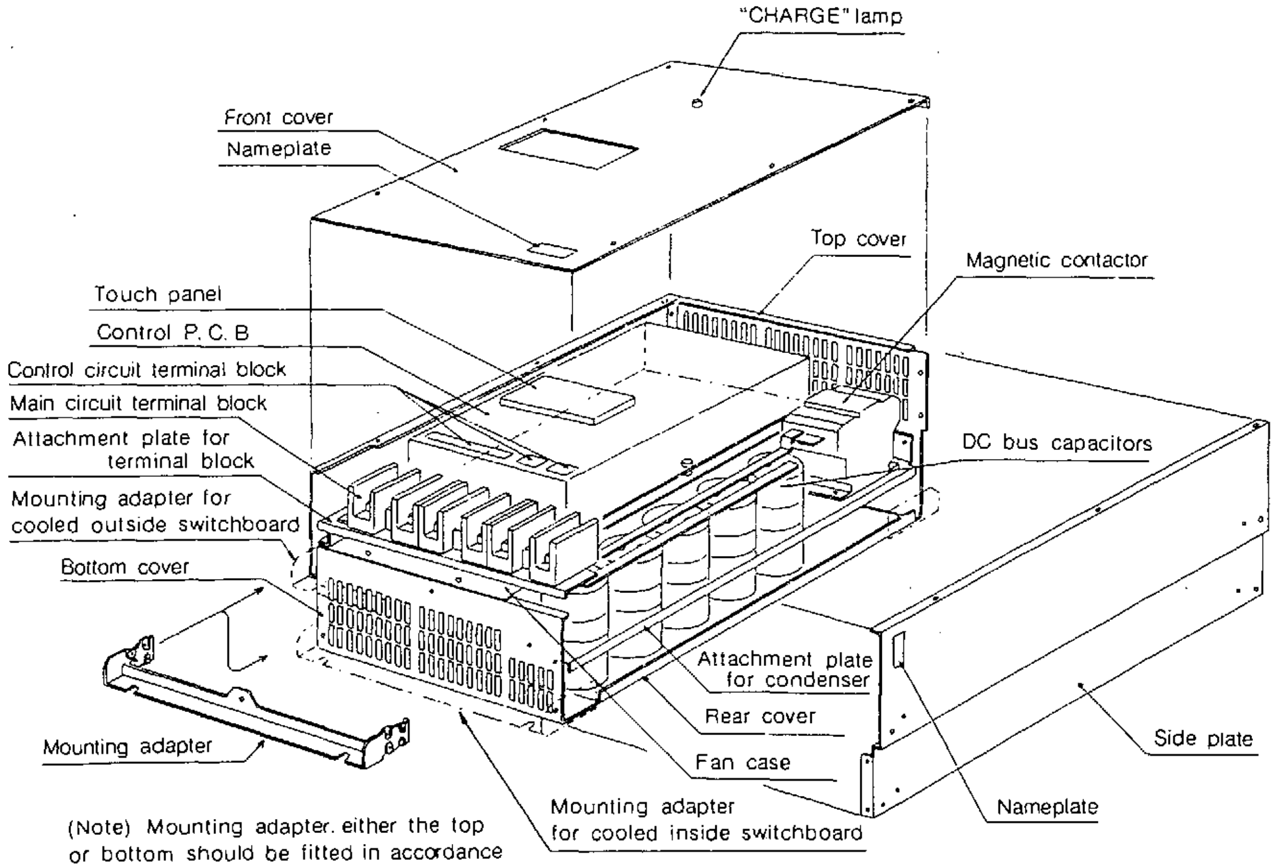
In some cases, the inverter is left intact for a long time after completing the installation. Particulary when it is delivered in the conditions where the construction work is going on, it will be subject to the exposure of water and dust. In such case, take temporary protective measures until the operation starts.

3. Construction

(1) 200V series: Inverters up to FRN055G7/P7-2EX, 400V series: Inverters up to FRN110G7/P7-4EX

There are two types of cooling methods depending on the installation method, "inverter cooled inside switchboard" and "inverter cooled outside switchboard". Fig. 3-2 shows a installation method for "inverter cooled inside switchboard", and Fig. 3-3 shows that for "inverter cooled outside switchboard" where a cooling fan is installed outside the unit. In the external cooling method, approx. 60% of the total amount of heat generated in the inverter is discharged outside the unit, facilitating cooling in the unit to achieve an economical unit design. However, because the cooling fan is installed outside the unit, take care to keep it clean in a dusty environment due to thread wastes.

The unit has a two method applicable structure to meet each case by switching an attachment leg position, as shown in Fig. 3-1. If you require "inverter cooled outside switchboard", please move the mounting adapters to the specified positions.



(Note) Mounting adapter, either the top or bottom should be fitted in accordance with the installation method, as shown in the following diagrams.

Fig. 3-1 Construction of FRENIC 5000G7/P7 series (1)

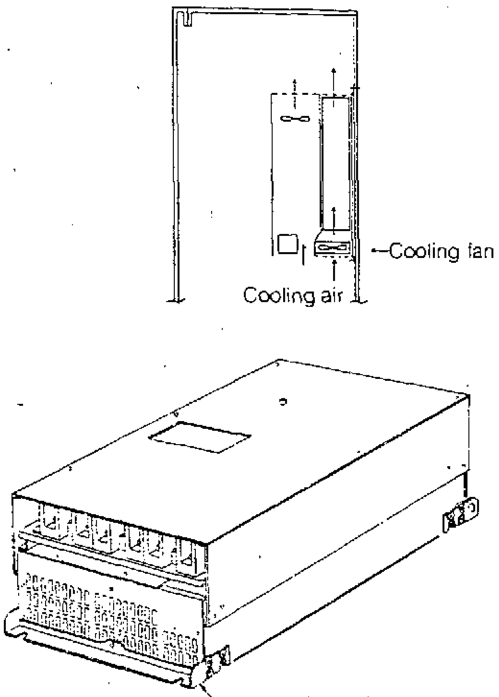


Fig. 3-2 Inverter cooled inside switchboard

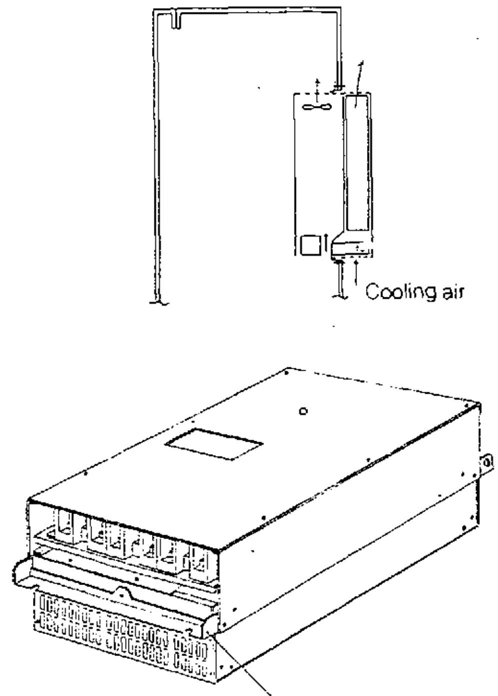


Fig. 3-3 Inverter cooled outside switchboard

(2) 200Vseries: Inverters more than FRN055G7/ P7-2EX, 400V series: Inverters more than FRN110 G7/ P7-4EX

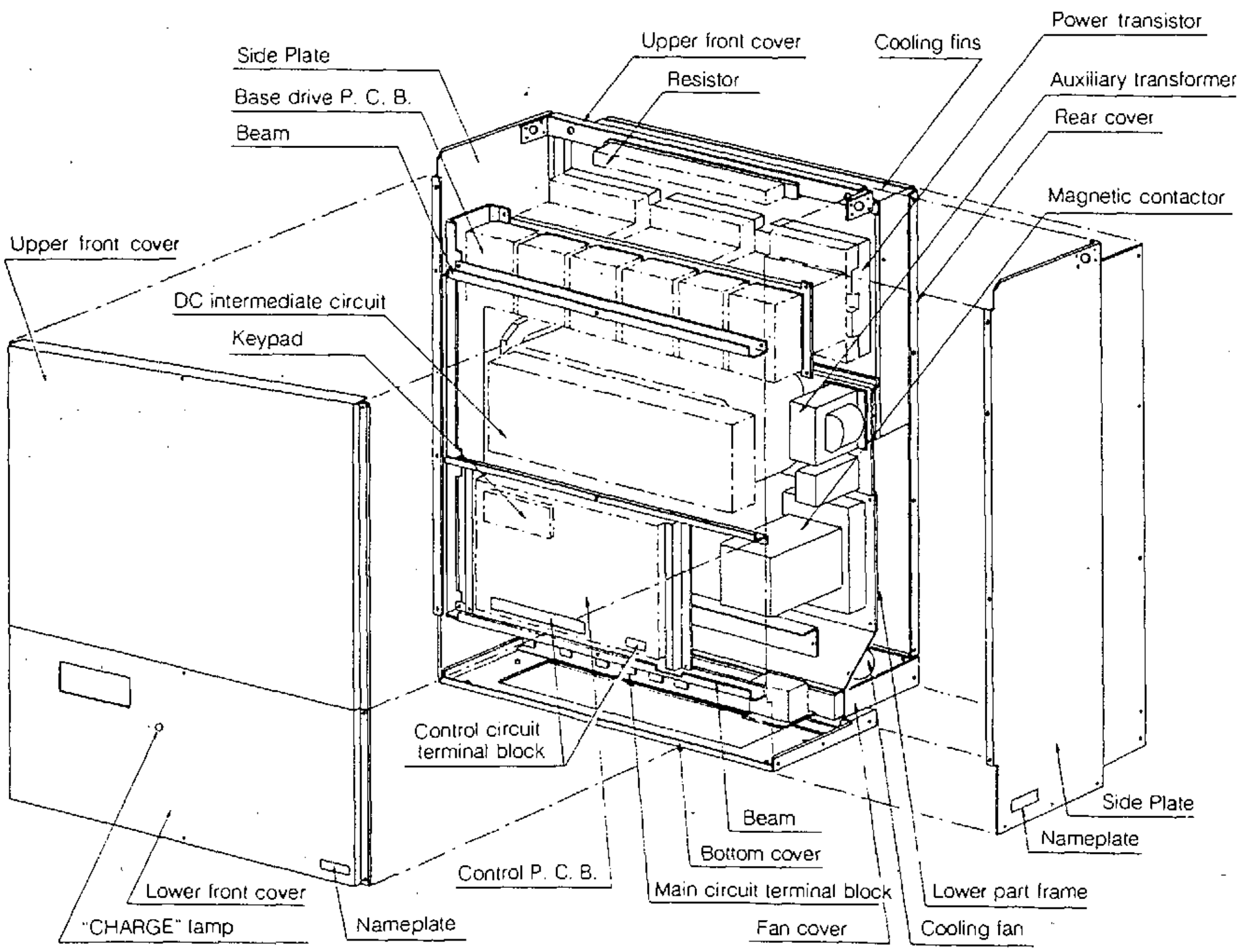


Fig. 3-4 Construction of FRENIC 5000 G7/ P7 series (2)

4. Installation

4-1 Environment for Use

The environments where the inverter is used are extensively various, and can affect greatly its performance and service life.

FRENIC 5000G7/P7 series are designed for the use in the environment conditions described in Table 4-1.
Particulary, in the case of being incorporated into machines, etc., provide sufficient vibration proofing measures.

Table 4-1 Environmental conditions for the use

Ambient temp.	−10~50℃	Nocondensing and nonicing due to a sharpe change in temperature
Relative humidity	20~90%RH	
Altitude	Not more than 1000m	
Atomosphere	The amount of dust and oily dust contained is small. There should be no corrosive gases, no inflammable gases, no oilmist, no vapor, no water drops, and no sun light contained much salt.	
Vibration	Not more than 0.5G	

4-2 Direction and Space

(1) Installation direction

NOTE: Install the inverter in the perpendicular direction against the ground. If the inverter is installed opposite, it should be over-heated.

(2) Space

NOTE: The inverter generates heat with the generating of loss. In order to discharge the heat, a cooling fan is built in to cool by means of forced feed cooling. Sufficient spacing should be provided to reduce obstacles to ventilation and effects on the surrounding, as shown in Fig. 4-2.

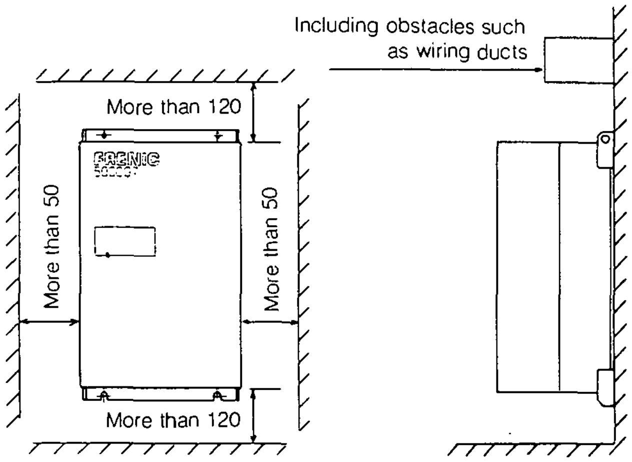


Fig. 4-2 Space around Inverter

4-3 Caution on Installing inside a Switchboad

CAUTION: Because the ambient temperature greatly affects inverter life and reliability, do not install the inverter in any location that exceeds the allowable temperatures.

(1) The temperature inside the switchboard should be kept at not more than 50℃.
(2) Considering an increase in temperature inside switchboard, do not store in a small sealed box nor fill the space surrounding the inverter with parts, heat generators, etc.

NOTE: When installing a cooling (ventilation) fan to the switchboard, make a design so that the air for cooling can pass through the heat generating part.

The improper installation positions of Inverter and Fan may result in preventing the temperature surrounding the inverter from reducing to the specified value, even if the fan which has the required cooling capability has been installed.

NOTE: In the case of installing more than one inverters in the switchboard, arrange them horizontally, as shown in Fig. 4-3 (a). When the vertical arrangement (upper and lower) is inevitable, provide a partition board between inverters to give no effect at all of the heat from the lower inverter to the upper one.

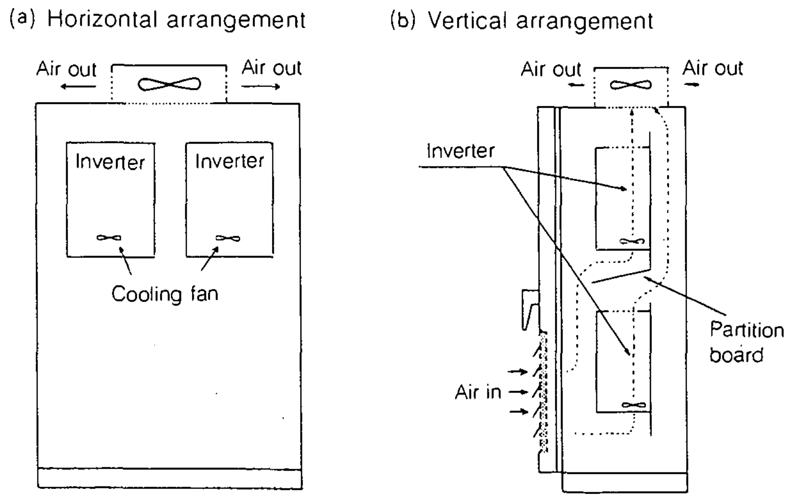


Fig. 4-3 Inverter arrangements in a switchboad

5. Connection and Wiring

Connections should be carefully implemented in accordance with the following procedures. After completing the connections, be sure to confirm that each wiring has been properly provided. Note that the incorrect connections may cause damages the inverter as well as its improper operation.

5-1 Terminal position and Connections at Shipment.

Under the top cover, the main circuit terminals and control circuit terminals are arranged at the bottom part of the Inverter. At the time of shipment, P1-(+) (except ① to ③ shown as below) and CM-THR are connected with short-circuit conductors.

NOTE: In the following inverters connect the DC reactor to P1-(+), otherwise inverter does not operate.
- **① Inverters of 75kW and above [G7 series 200V/ 400V]**
- **② Inverters of 75kW and above [P7 series 200V]**
- **③ Inverters of 90kW and above [P7 series 400V]**

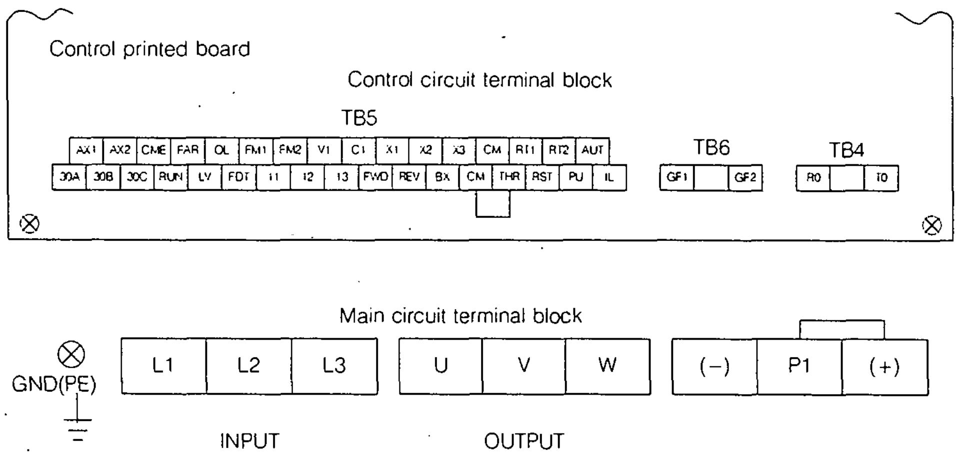


Fig. 5-1 Terminal positions and connections at Shipment

5-2 Main circuit

CAUTION: Be sure that the power supply is never connected to the U, V, W terminals or the (+), P1, (−) terminals.

(1) Connection for Power supply

Do not fail to connect a breaker for wiring (MCCB) between the three-phase circuit power supply and the main circuit terminals (L1, L2, L3). The phase order matching is not required for the connection. Also, connect Magnetic contactor (MC) to cut off the power supply when the inverter protective function actuates, to prevent faults from expanding.
If the MC is turned on and off by a run and stop command, the interval of switching should be less than once an hour. Otherwise, the inrush currents will reduce the service life of the internal components. When the inverter is turned on and off more than once, keep the MC on, run and stop by FWD or REV.

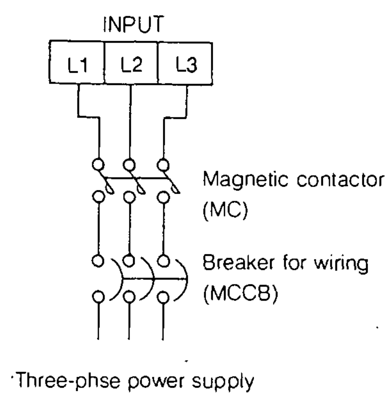


Fig. 5-2-1 connection for Power supply

(2) Connection for the Output side

① Cut off the power supply before connectig the output wire. When the connection has been made while the power supply is ON, a voltage may be impressed between the output terminals, even though the inverter is in a stopping state.

NOTE: When the inverter output terminals (U, V, W) have been connected as shown in Fig. 5-2-2. Forward command will bring the motor in the counterclockwise rotation viewed from the drive side (at Japanese standard motor). When the rotation is reverse, switch two phases among phases U, V, W.

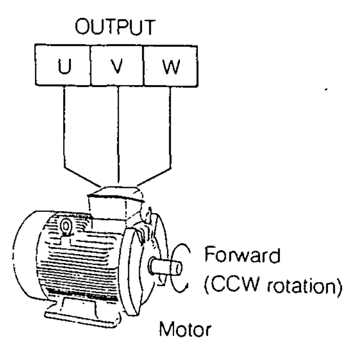


Fig. 5-2-2 connection for Electric motor

② Do not connect the power supply to terminals U, V, W
A voltage externally impressed will damage the inverter. For this reason, when the commercial switching operation is performed, as shown in Fig. 5-2-3, be sure to install Magnetic contactor (MC-2) and to provide electrical or mechanical interlock to prevent turning on MC-2 in the operation using the commercial power supply.

③ The connection for capacitor is not allowed: otherwise, an inverter and a capacitor will be overheated due to harmonics resulting damaging them.

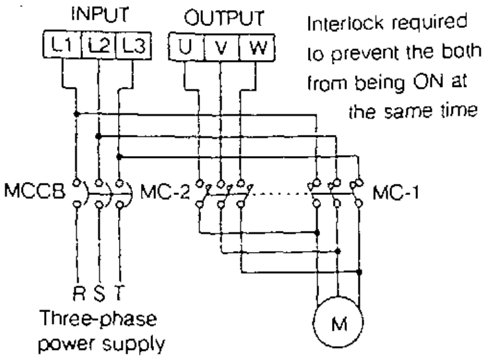


Fig. 5-2-3 Interlock for Commercial switching operation

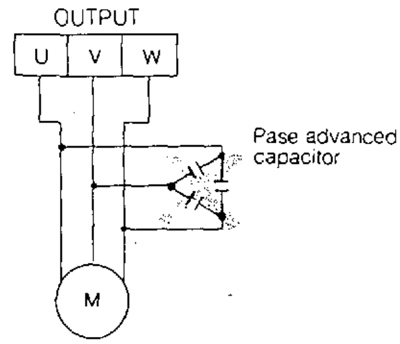


Fig. 5-2-4 Prohibited connection for Capcitor

(3) Connection for DC reactor for Power factor improvement
In the case of connecting DC reactor to Inverter which is not equipped as the standard (supplied outside the unit), detach a short-circuit conductor between terminals P1-(+) connected at shipment, and then connect to those terminals. As to find the location of a short-circuit conductor, look round a port for conductor-connection in the unit (inside) where the conductor is connected.

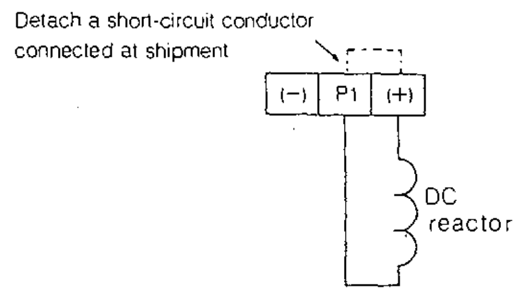


Fig. 5-2-5 Connection for DC reactor

(4) Connection for Grounding terminal

WARNING-HAZARD OF ELECTRICAL SHOCK: All motor bases and inverter enclosure housings should be grounded in accordance with the electrical standard.

It is necessary to provide the grounding in order to be protected against an electric shock due to an electric leakage and to reduce effects of a noise. Preferably, the grounding should be provided for its exclusive use.
If it is not possible to have an exclusive grounding, then the alternative one is a common grounding to connect to a ground wire for other equipment at the ground point.
Avoid the grounding where the ground wire is used in common with other equipment. The size of a wire needs to be thick, and the distance should be short.

(a) Grounding for a exclusive use (Good)
(b) Grounding for a common use (Possible)
(c) Grounding for use with a common ground wire

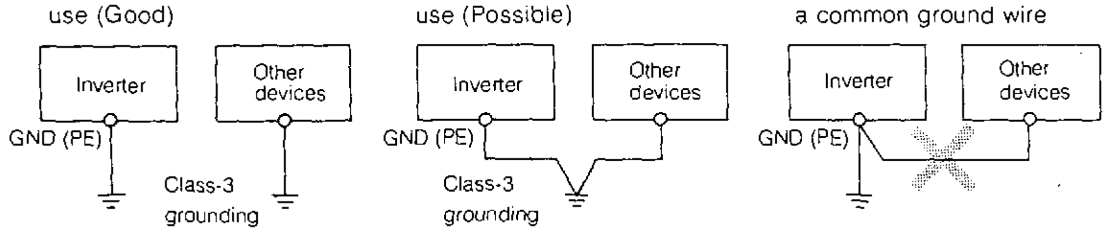


Fig. 5-2-6 Possible connections of the ground wire

(5) Tap change for Auxiliary transformer
When the supply voltage is 400-440V/400-460V 50/60Hz, change the tap, U1.
When the supply voltage is 380V 50/60Hz, change the tap, U2.

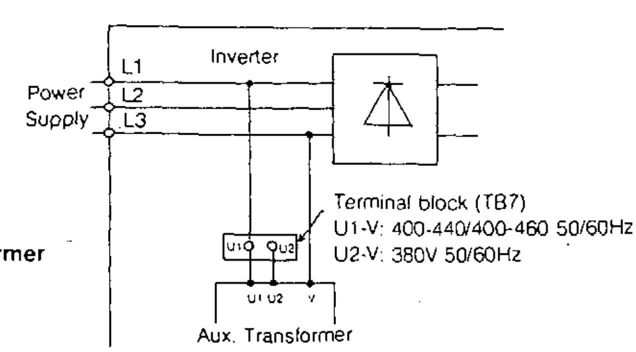


Fig. 5-2-7 Connection for Aux. Transformer

5-3 Control circuit

Provide the wiring in accordance with the following diagram and description. The function of each terminal should be referred to "Terminal, 11-4"

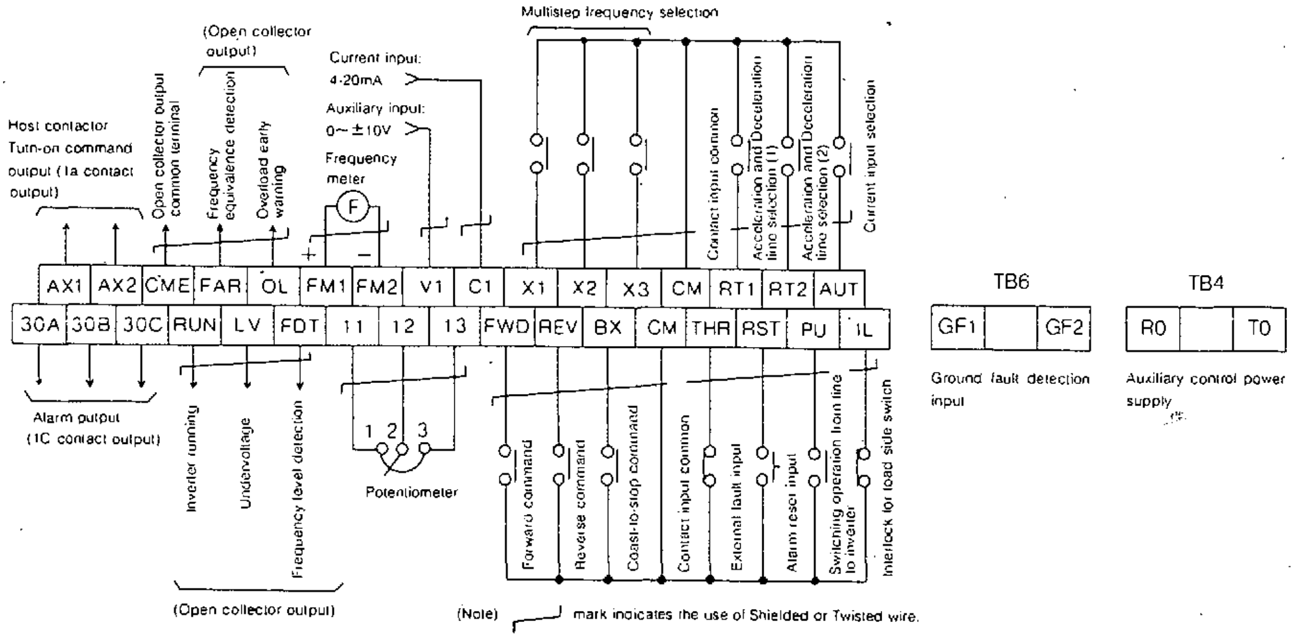
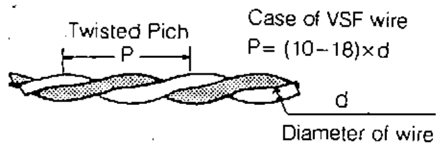


Fig. 5-3-1 Connection for Control circuit terminals

(1) Wiring for Control circuit terminals

> **NOTE: For the wiring control circuit terminals, use a shielded or twisted vinylwire, and keep the distance not less than 100mm away from the main circuit. However, if wire-crossing is inevitable, wire each to cross at the right angle. For the longer wiring route, a twisted-shielded wire is recommended.**



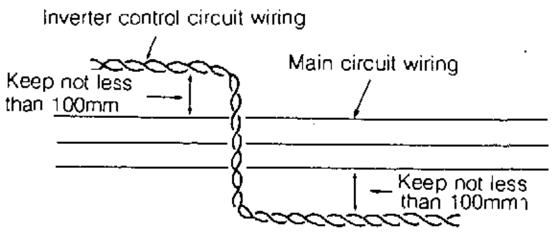


Fig. 5-3-2 Wiring for inverter control circuit

(2) Connection for Control power supply auxiliary input terminal
The control power within the inverter is usually supplied from DC intermediate circuit.
When the protective circuit actuates, if a magnetic contactor of the power supply side is turned off, that will result in cutting off the control power of the inverter, and therefore the fault display and the collective alarm output signal cannot be held. When a continuous actuation of the protective circuit is required, connect with Aux. Control power supply terminal R0 and T0 as Fig. 5-3-4.

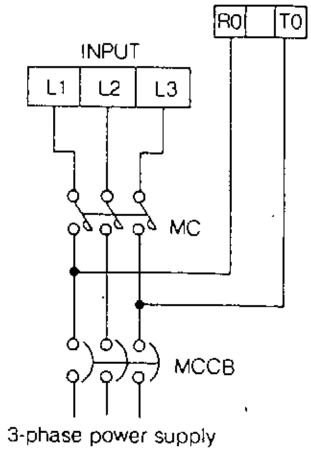


Fig. 5-3-4 Connection for Control power supply

(3) Connection for Frequency setting/ Monitoring terminals

For the input voltage polarity of each of Frequency setter connecting terminal (12) and Voltage input auxiliary terminal (V1), both (+) and (−) are applicable. When a frequency setter is used, the polarity can be switched by means of switch SW1 on the printed board (See Fig. 5-3-6 for the installed location).

Note that the polarity at shipment is set at (+).

Control printed board

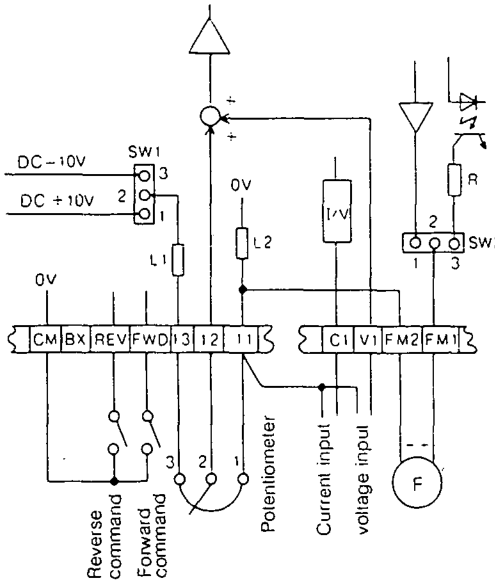


Fig. 5-3-5 Connection for Frequency setting terminal and for Monitoring terminal

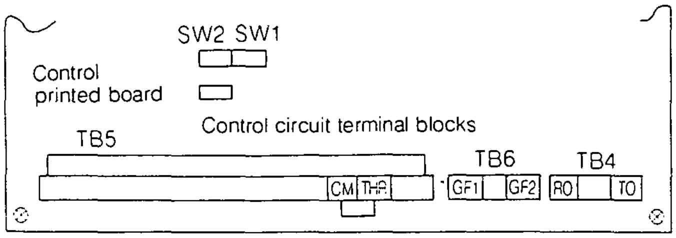


Fig. 5-3-6 Position of switch SW1 and SW2

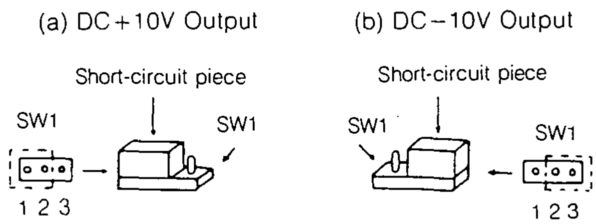


Fig. 5-3-7 Switching of SW1

(4) Connection for Current input selection terminal

> **NOTE: Without switching of external frequency signals, it is possible by switching ON-OFF between AUT-CM that switching Voltage signals from Frequency setter and Voltage auxiliary input terminal with Current signals.**

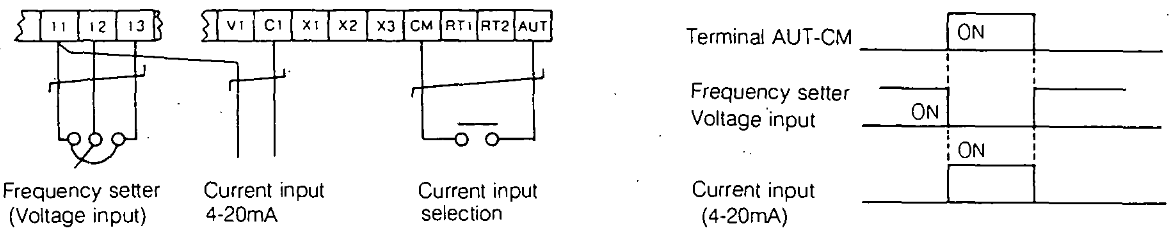


Fig. 5-3-8 Switching of Frequency set signals

(5) Connection for Frequency meter terminal

Although output frequency is digital-displayed, when the external display such as a display on the inverter panel is required, connect a meter to terminals for the frequency meter (FM1, FM2). Instruments, either analog or digital types, can be connected. Set SW2 in accordance with the instrument used, as shown in Fig.5-3-9. The setting at shipment is for analog instrument.

> **NOTE: The frequency meter (FM1, FM2) circuits are designed for meter. Because this circuit has filter, the response time of output is approximately 3sec.**

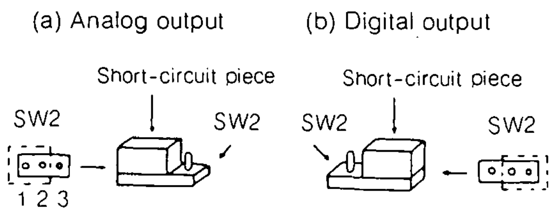
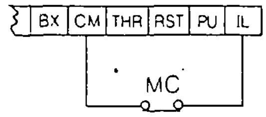


Fig. 5-3-9 Switching of SW2

(6) Connection for Output interlock terminal
When the magnetic contactor (MC) is used on the inverter output side, Connect NC (Normally closed) contacts of MC between IL-CM.
For using this terminal, the inverter is able to restart after Power failure. When the power failure occurs and IL-CM is closed, the output frequency is memorized and the inverter stops. When the power is reapplied (IL-CM is opened), the first inverter output frequency is the memorized frequency at the power failure. The frequency is reduced at the predetermined rate until catching the motor speed. After catching the motor, the inverter accelerates or decelerates to the reference frequency at this time.



ON between IL-CM: Inverter stops

OFF between IL-CM: Inverter restarts

Fig. 5-3-10 Connection for Output interlock terminal

(7) Connection for Alarm reset switch
To operate alarm reset from the other place than the inverter (the inverter panel, etc.), connect a self-reset switch to RST terminal, as shown in Fig.5-3-11. Note that the application of this terminal allows a parallel operation to be performed with the reset key of Touch panel. Therefore, careless operations at setting parameters and retrieving faults may result in inputting a reset signal, careful operations are required.

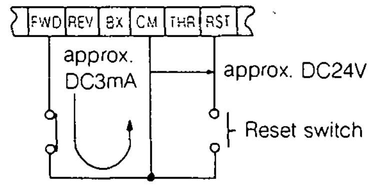


Fig. 5-3-11 Voltage and Current of Contact input terminal

(8) Contacts to be connected to Frequency setting/ Contact input terminals
In this circuit, voltage and current such as those shown in Fig. 5-3-11 are impressed.
Due to micro current, the contacts to connected should be highly reliable contacts for micro signals, e.g.: Fuji control relay: HH54PW, etc.

(9) Contact capacity for Contact output
The capacity is: AC250V 0.3A (COS ϕ =0/3)
In case of switching a large capacity magnetic switch, use a relay which has a large capacity of contact as shown in Fig. 5-3-12.

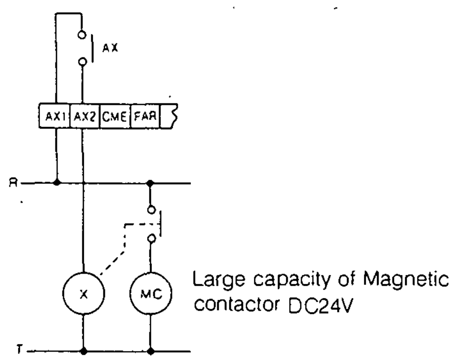


Fig. 5-3-12 Amplification of Contact capacity

(10) Connection of Open collectorer output terminals
For the use of these output signals, it is recommended to use a relay output unit (MCA II -RY). If not, the electrical specifications for open collector are: DC27V max. 50mA max.

CAUTION:	**Be careful to protect it from damage due to surge voltage and not to mistake power supply polarity.**

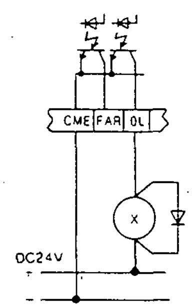


Fig. 5-3-13 Connection for Open collector output terminals

(11) Connection for Surge absorber

CAUTION:	**Connect a surge absorber directly to the both ends of the coil which is a the causing source. The wiring should be as short as possible, 20cm at longest.**

When a magnetic coil circuit such as a magnetic contactor, control relay, and solenoid valve, opens and closes, the current will sharply fluctuate resulting in generating a surge voltage (noise). In some cases, this surge voltage may cause to misoperate the electric circuits of Inverter and the peripheral equipment.

Table 5-3-1 Application of Surge absober
(Circuit voltage: Not more than 250V)

Equipment		CR filter or Diode
Magnetic contactor	DC	S2-A-O or the equivalent
(Main circuit)	AC	Diode or S2-A-O
Auxiliary relay	DC	S1-B-O or the equivalent
	AC	Diode or S2-B-O
Solenoid braking	DC	S2-A-O
Braking clutch	AC	Dode

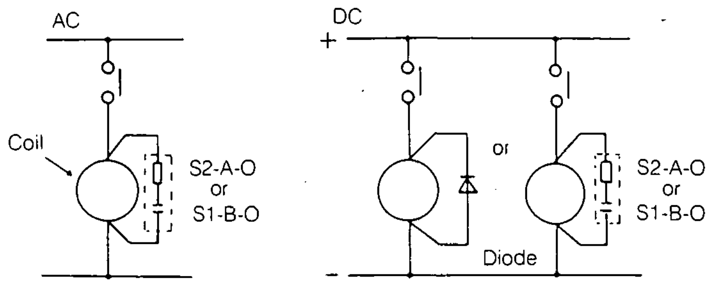


Fig. 5-3-14 Connection for surge voltage

- Specifications of S1-B-O and S2-A-O
  : Refer to "12. OPTION" (Page.64)
- Capacity of Diode (when the current of the operating coil is no more than 1A)
  ERB44-06C 600A 1A (Surge 30A/10ms) (Product of Fuji Electric)

5-4 Braking circuit

CAUTION: If the (+)-(−) terminals are short-circuited or connected a braking resistor directly without a braking unit, damage to the inverter will result. Do not fail to match terminal symbols (+) and (−) between inverter and braking unit.

① As shown in Fig. 5-4-1 the number of braking units and braking resistors in the combination differs in the type of unit. Connect them as the instruction of the Table 12(2) Braking unit and Braking resistor specifications (Page 63, 64).

NOTE: Detach the short-circuit conductors connected between THR-CM at shipment, and connect thermal contacts in series so that both the braking unit and the braking resistor will be OFF at overheating. If not connect, the braking circuit will not operate.

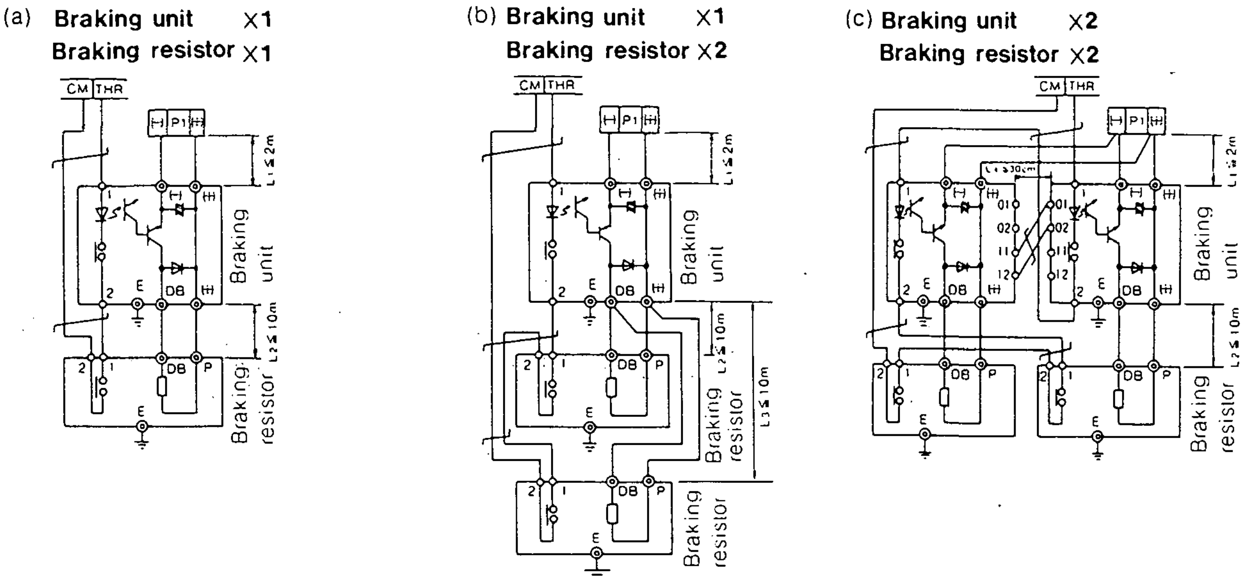


Fig. 5-4-1 Connection for Braking unit and for Braking resistor

② When 2 braking units are used, set Switch SW1 on the printed board of a braking unit as shown in Fig. 5-4-2 (a). The setting at shipment is (b) in the figure.

(a) Braking unit where terminals I1, I2 are connected (b) Braking unit where terminals O1, O2 are connected

Fig. 5-4-2 Switching of SW1

6. Touch panel

6-1 Function and Configuration of Touch panel

The setting/ display apparatus installed on the front panel of Inverter is called Touch panel, which is used for the data display and the parameter setting and modification. Inverter is operated with the parameters set by this touch panel and with the external operation/ control commands. The flow of this actuation is shown in Fig. 6-1-1.

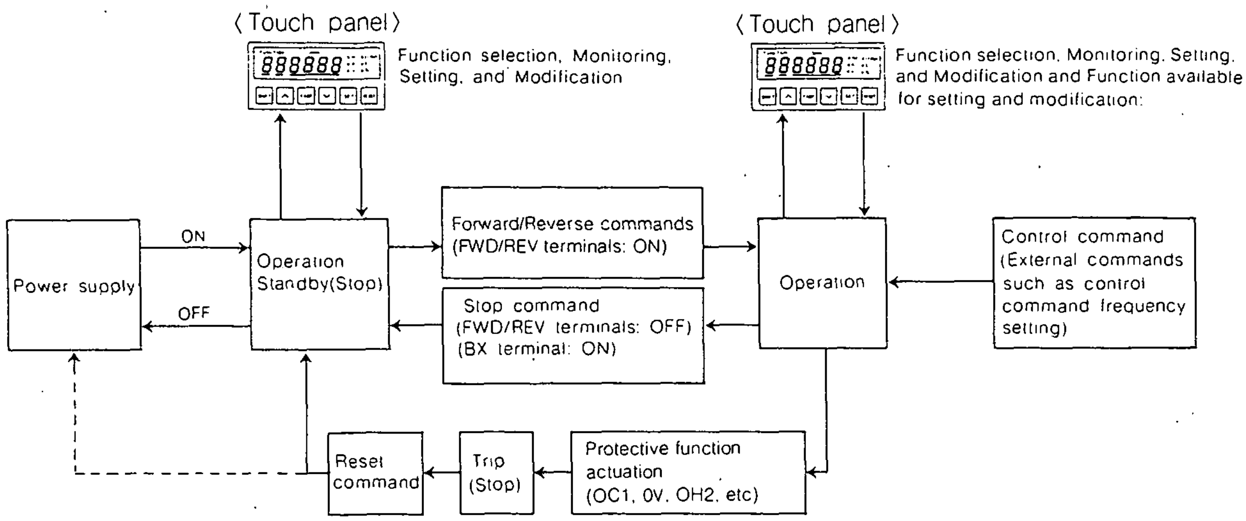


Fig.6-1-1 Basic actuation of FRENIC 5000 G7/ P7 series

Table 6-1-1 Functions of Keypad

Function		Description
Operation monitoring		Monitor the operation states of Inverter
Parameter setting	Basic parameter	Set data required for operation
	Auxiliary parameter Correcting parameter	Set data required for control Adjust output signals to match with instruments externally installed
Set data protection		Protect set data against careless operations
Fault display and retrieval		Display and Retrieval the class of Fault and the operation state at fault
Reset		Data reset at parameter setting, Set error display reset, reset to return to operation monitoring mode after completing the setting, and fault reset

Table 6-1-2 Display characters

Number	Displayed character	Number	Displayed character	Letter	Displayed character	Letter	Displayed character	Letter	Displayed character
0	0	5	5	A	A	F	F	U	U
1	1	6	6	B	b	H	H	V	U
2	2	7	7	C	C	L	L	ACTIVE	°
3	3	8	8	D	d	O	0	INACTIVE	-
4	4	9	9	E	E	R	r		

Function selection indicator

Display the selected digits at function selection. But, in the data display retrieval mode and the parameter setting mode (when shifted the sellected function to the data display), the both two digits will go out.

Function display indicator

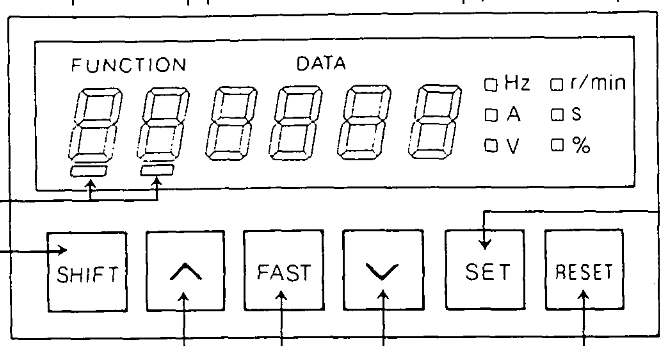
Display, in two digits, a selected function in number (Code).

Data display indicator

Display operation data each type of parameter setting data and fault states.

Unit indicator

THE LED on the left of each unit symbol corresponding to the contents of a data display.



Set key

Used to enter set data into the memory at parameter setting.

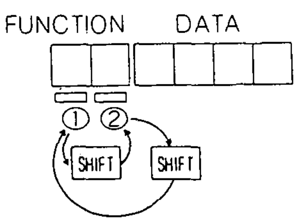
- When a new data has been set, the data will flicker. Pressing [SET] will enter the data into the memory, and then the flicker will stop.
- Note that the data which once have been entered (stored) in the inverter do not disapper even after turning off the power supply.

Shift key

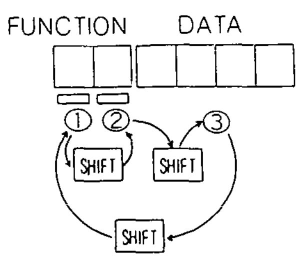
Used to set and retrieve of functions and data. And select Parameter setting mode.

■ Selection order

- Function: 00 to 05, 08 to 0b, F1 to F3, F5 to F7



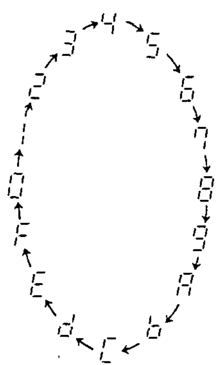
- Other functions



■ When the data on the data display is flickering, you can not change the selection by pressing [SHIFT]. Try the operation after stopping the flicker by pressing [SET] or [RESET].

Up key

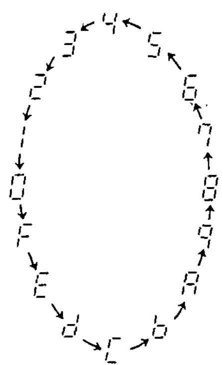
The digit selected with the [SHIFT] key changes as indicated by the arrow in the figure below.



- Values which do not represent an inverter function are skipped.
- When parameter data setting, values are set limits of lower.

Down key

The digit selected with the [SHIFT] key changes as indicated by the arrow in the figure below.



- Values which do not represent an inverter function are skipped.
- When parameter data setting, values are set limits of upper.

Fast key

The speed at parameter setting can be increased with combinations of [∧] [∨].

■ Moderate speed can be achieved by pressing [FAST] one time, and high speed by pressing it two times, while pressing [∧] or [∨]. Release [∧] or [∨] to clear the moderate and high speed settings.

[∧] or [∨] ⇨ Low speed
[∧] or [∨] + [FAST] ⇨ Moderate speed
[∧] or [∨] + [FAST] + [FAST] ⇨ High speed

Reset key

Used as follows:

■ Parameter setting mode

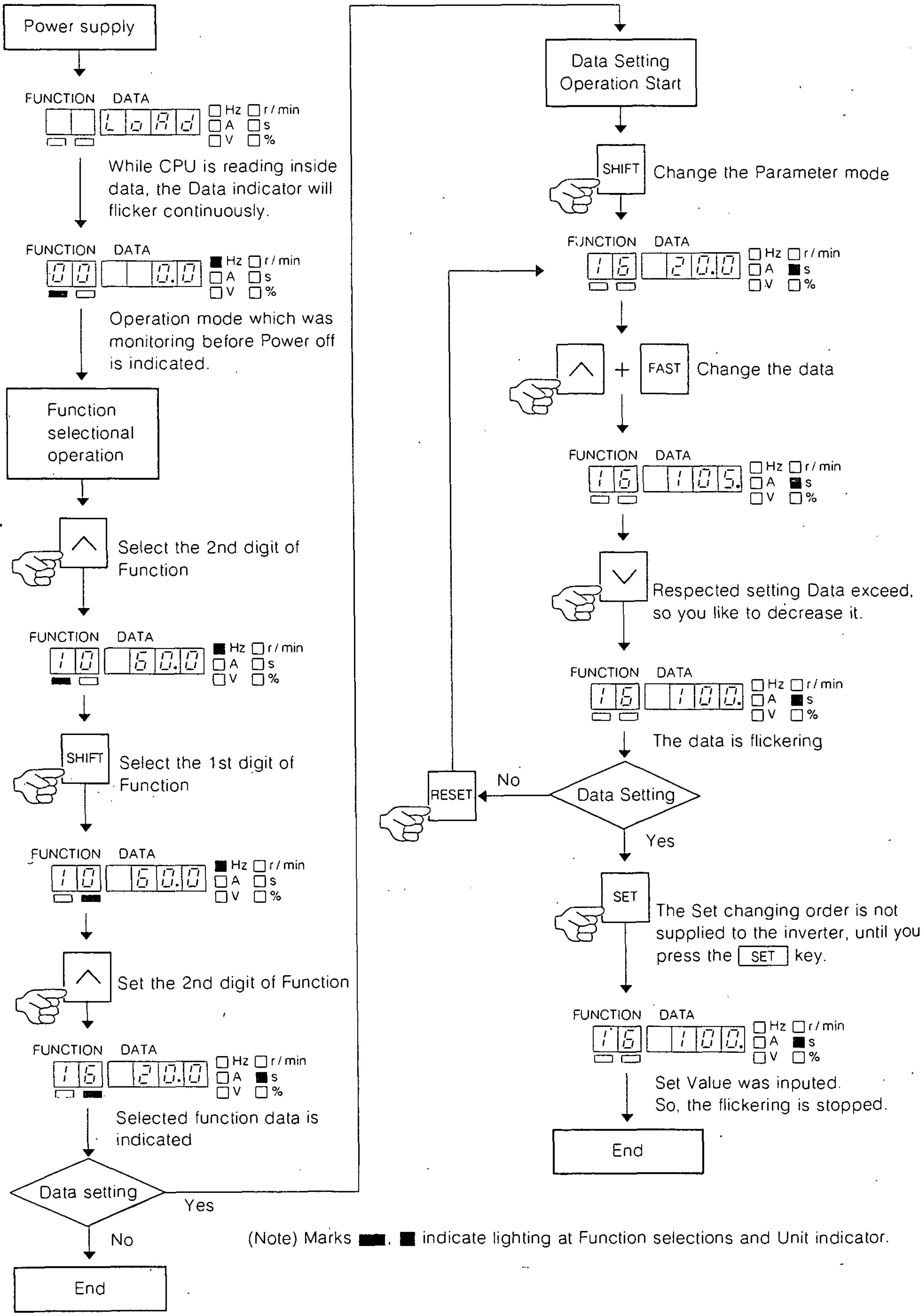
- Reset of Set data
  Press [RESET] prior to [SET] in parameter setting mode, and the set data will be cleared so that you can return to the original data.
- Reset of Set error display
  Press it after inverter stopping when "Err" has been displayed due to the incorrect setting, and the set data will be cleared so that you can return to the data preceding the setting.
- Return to operation monitoring mode after completing the setting.
  You can return to the function for operation monitoring which had been selected and displayed before setting parameter.

■ Fault monitoring mode

- Fault reset
  Turn off the run command and press [RESET] after solving the problems, and the pretective function actuating will be cleared so that you can return to the function mode selected before the fault occurred.

6-2 Basic operational procedure of Touch Panel

After few seconds from applying power, touch panel indicates the monitor function which was monitoring before power being turned off, and it is able to select the function and set the data.



(Note) Marks ▬, ■ indicate lighting at Function selections and Unit indicator.

6-3 Function selection and displayed data retrieval

(1) Function selection

procedure	Examples of Operation and display Case to swich a mode from Set value display mode for the number of poles of motor (Function: 3d) to monitoring mode for Synchronous speed (Function: 02)		
	Operation	Display	Description
————	—	FUNCTION DATA 3d 4 □Hz □r/min □A □s □V □%	Display Function and Data for the number of poles of motor. (Display ex.: In case of 4-pole motor)
Press SHIFT and confirm the light of the function selection indicator ①. Then, the 2nd digit of Function will be selected.	Press SHIFT two times	FUNCTION DATA 3d 4 ① □Hz □r/min □A □s □V □%	Switch the lighting position of Function selection indicator to select the 2nd digit of Function.
Press ∧ or ∨ to set the code of the 2nd digit of Function required. At this time, the code of the 1st digit of Function will be set at 0.	Press ∨ three times	FUNCTION DATA 00 60.0 ■Hz □r/min □A □s □V □%	Change the display at the 1st digit of Function to 0 as well as that at the 2nd to 0 to display an output frequency at the data display. (Display ex.: When output frequency is 60Hz)
Pressing SHIFT one time will put out the function selection indicator ① and light ②, and then the 1st digit of Function will be selected.	Press SHIFT one time	FUNCTION DATA 00 60.0 ①② ■Hz □r/min □A □s □V □%	Switch the lighting position of Function selection indicator, allowing the setting of the 1st digit of Function.
Press ∧ or ∨ to set the code of the 1st digit of Function. The function data set will be displayed in the data display, and its unit indicator.	Press ∧ two times	FUNCTION DATA 02 1800. □Hz ■r/min □A □s □V □%	Change the display at the 1st digit of Function to 2 to display a synchorous speed.

(Note 1) Marks ▬, ■ indicate lighting at Function selection indicators and Unit indicator.

(Note 2) Without the following cases, these displays will continue until a new function data is set.

① RESET operation after completing the parameter setting or changing.

② After completing the setting or release operating of "Function 99 setting data protection"

③ RESET operation at occuring an fault and after retrieving of contents of fault, operating conditions at the fault, and contents of Past failures.

Details should be referred to "6-4", "6-5", (Page 17 ~ 21)

(2) Display examples

Display item	FUNCTION		DATA				Unit display
	2nd digit	1st digit	4th digit	3rd digit	2nd digit	1st digit	
Frequency (When output frequency is 60Hz)	0	0		6	0.	0	■ Hz
Current (When output current is 100A)	0	3		1	0	0.	■ A
Voltage (When output voltage is 400V)	0	4		4	0	0.	■ V
Speed (When machine speed is 1750r/min)	0	5	1	7	5	0.	■ r/min
Time (When acceleration time is set at 10s.)	1	6		1	0.	0	■ s
Percentage (When torque limit is set at 120%)	3	3		1	0	0.	■ %
Code (When torque boost is set at "3")	1	9	C	-	-	3	
Selection (When automatic and energy conservation operations are set "to be specified")	1	A				o	
Factor (When frequency monitoring factor is set at "50")	4	0			5	0	
No. of poles (When the number of poles of motor is set at "4")	3	d				4	
State (When the state of input terminal is "In forward operation")	0	6	A	o	-	-	
Fault (When the 4th digit 1 indicates the first fault in overcurrent at deceralating)	F	0	1.	0	C	2	
Setting error (When the setting of the lower limit of frequency exceeds that of the upper limit frequency)			E	r	r	1	
Setting error (When a parameter which can not be set during operation has been set)			E	r	r	2	

(Note) Mark ■ indicates lighting on Unit indicator.

(2) Monitoring for display data (input and output signal)

Procedure	Examples of Operation and display Case to confirm whether open collector output terminal FAR has been output		
	Operation	Display	Description
————	——	FUNCTION DATA 02 1800 Hz ■r/min A s V %	Example continued from (1)
Press [SHIFT], [∧] or [∨] to select the Function required. The contents of A shown in the function column will be displayed in the data display.	Press [∧] five times	FUNCTION DATA 07 Ao -.- Hz r/min A s V %	Select the output signal check function to display each state of AX, OL, LV. (o : Output signal received, - : No output signal received)
Pressing [SHIFT] will put out the function selection indicator ②, it will change to Data retrieval mode. At the same time, it will allowed the retrieval for the data display.	Press [SHIFT] one time	FUNCTION DATA 07 Ao -.- ② Hz r/min A s V %	Put out the function selection indicators to switch to data retrieval mode. No changes in other displays.
Press [∧], and the contents of b will be displayed in symbol. Under the selection of Function 05, pressing [∧] in turn will display each contents of C, d, E in order.	Press [∧] one times	FUNCTION DATA 07 bo o - Hz r/min A s V % FAR signal is displayed at this digit.	Switch the display contents to the confirmation state of each of RUN, FAR, FDT to display the state of RUN output signal required at the 2nd digit on the data display.

6-4 Parameter setting

Procedure	Examples of Operation and display. Case to modify the setting of base frequency 50Hz to 60Hz:		
	Operation	Display	Description
Press [SHIFT] to select the 2nd digit of Function. and press [∧] or [∨] to set the 2nd digit of required function.	Setting procedures Set the 2nd digit of Function	FUNCTION DATA 10 80.0 ■Hz r/min A s V %	Display 0 at the 1st digit at the same of setting 1 at the 2nd digit, and also display the max. frequency on the data display. (Display ex.: When the max. frequency is 80Hz)
Press [SHIFT] to set the 1st digit of Function.	Press [SHIFT] one time	FUNCTION DATA 10 80.0 ■Hz r/min A s V %	Change the lighting position on Function selection indicator to select the 1st digit of Function.
Press [∧] or [∨] to set the 1st digit of Function required.	Press [∧] one time	FUNCTION DATA 11 50. ■Hz r/min A s V %	Change the display at the 1st digit of Function to 1 to display the current set base frequency.
When [SHIFT] is pressed, the function will shifts to parameter setting mode.	Press [SHIFT] one time	FUNCTION DATA 11 50. ■Hz r/min A s V %	Put out Function selection indicator to switch to parameter setting mode.
Operate with the combinations of [∧], [∨], [FAST] to set data. Confirm the set data. At the time,the data is flickering. For revising data,use [∧], [∨], [FAST] to reset it.	Keep pressing [∧] and release it when the display shows 60	FUNCTION DATA 11 60. ■Hz r/min A s V % Flicker	Confirm the set data flickering on the data display
Press [SET] to determine the entry, and the flicker of the set data will stop, and then the inverter will operate with data set. Press [RESET] to stop in the middle of the operation. When selecting other function, press [SHIFT] to switch to function selection mode.	Press [SET]	FUNCTION DATA 11 60. ■Hz r/min A s V % Flicker stops	Stop flickering to enter the data into the memory

WARNING - HAZARD OF MOTOR OVERSPEED:
The maximum frequency is 400Hz, which is equivalent to 12000r / min of high speed rotation in 4-pole motor. In such condition, the incorrenct setting may result in a catastrophic failure for the machine.In order to prevent this, 14 : High limiter of output frequency upper limit is provided. Set the upper value with this function to carry out safety operation.

CAUTION: When the DC braking function is used, large value setting for 21 : DC braking voltage and 22 : DC braking time will cause heating of motor. The setting appropriate for the capability of motor is required.

NOTE: Set the parameter during inverter stopping.
If you set the parameter during inverter operation, the data display will display the error code.
Few parameter can be set during inverter operation. Details should be referred to "Functions table 11-3" (Page 33, 34)
"Inverter stopping" means to the states as follows.

ⓐ State changed function display of operation mode from LoAd display after power has supplied.
ⓑ Stop state after providing stop commands. (FWD, REV-CM: OFF)
ⓒ State provided free run command.
ⓓ After turning off fault display.

NOTE: Press SET (data memorying) certainly, after parameter setting. Otherwise, this setting will get to invalidity.

NOTE: The priority order in the case where the inter-harmony among parameters on output frequency: 10, 13, 14, 15, 18, and 23 ~ 29 can not be made is shown as follow:
1st order 14 : Output frequency high limiter
2nd order 15 : Output frequency low limiter
3rd order 23 ~ 29 : Multistep frequency selection
4th order 10 : Max. frequency 13 : Bias frequency, 18 : Frequency setting gain

NOTE: For the use of the following parameters, note that 14 : Output frequency high limiter and 15 : Output frequency low limiter are not applicable to them.
20 : DC braking start frequency 37 : Starting frequency

NOTE: When torque limit acceleration and deceleration are extermely frequency performed, depending on the repeating frequency, the limit may exceed the capabilites of motor and of Inverter. Therefore, some measures, such as to reduce the setting level of torque limit, need to be taken. In such cases, if there is any unclear matter, please consult us.

NOTE: For setting 40 : Digital frequency monitor coefficient and 50 : Analog frequency meter calibration, switch, in advance, the output selector switch for frequency meter (SW2), as shown in Fig. 5-3-9.

NOTE: The functions having Active (o) or Inactive (-) are also set by using ∧ or ∨ .
∧ : Active (o), ∨ : Inactive (-)

NOTE: If the following operations are done, the data indicator displays setting error.
But , the inverter continues to run by the data before setting. In these cases, after stopping the inverter and pushing the RESET, set the data once more.

6-5 Fault display and retrieval

(1) Display and retrieval of fault contents

Procedures	Example of operation and display Case, at braking using braking unit and braking resistor in the option, where the protective function has actuated by detecting overvoltage and heating of the braking resistor at braking:		
	Operation	Display	Description
When a fault has occurred, the mode will be switched from other monitoring mode to fault monitoring mode, F0 , the fault order 1 ,and its class will be displayed in code, and then the function selection indicator ② will light.	——	FUNCTION DATA F 0 1. 0 U □Hz □r/min □A □s □V □% ② Flicker	Switch automatically to fault monitoring mode. The class of the first fault is displayed, and the code will flicker. (Display ex.: When the first detected fault was overvoltage)
The details of the fault need to be retrieved since it may be complex. First, press SHIFT to switch to faultdetail retrieval mode. At this time, the function selection indicator ② will turn off.	Press SHIFT one time	FUNCTION DATA F 0 1. 0 U □Hz □r/min □A □s □V □% ② Flicker	Put out the function selection indicator to switch fault retrieval mode. No changes in other displays.
Press ∧, and the 2nd fault details (order 2 and class in code) will be displayed.	Press ∧ one time	FUNCTION DATA F 0 2. 0 H 2 □Hz □r/min □A □s □V □% Flicker	Display 2 at the first digit on the data display, and the class of the 2nd fault in code, which will start flickering. (Display ex.: When the second fault was overheating of a braking resistor)
Press ∧ again, and similarly the 3rd fault details will be displayed. For the rest, repeat this operation until no class of fault appears.	Press ∧ one time	FUNCTION DATA F 0 3. - - - □Hz □r/min □A □s □V □%	No display on the data indicator since there is no 3rd fault.

The confirmation of fault has been completed at this stage.
When the confirmation on the operation data at fault and the fault history are not required, press RESET after solving the problems. By doing so, the protective function actuating will be cleared, and the monitoring operation mode on the indicator will switch to that preceding the occurrence of the fault to get the operation ready.
When you confirm on the operation data at fault and fault-history, operate as following.

(2) Retrieval of operation data at fault

Procedures	Example of operation and display		
	Operation	Display	Description
Press [SHIFT] to select the 1st digit of Function.	Press [SHIFT] two times	FUNCTION DATA F03.--- □Hz □r/min □A □s □V □%	Example continued from (1) Select the first digit of Function
Press [^] to select F1, and output frequency will be displayed. Similary, press [^] in turn, and: F2: Set frequency, F3: Output current, and F4: Operation state will be displayed.	Press [^] one time	FUNCTION DATA F1 25.5 ■Hz □r/min □A □s □V □%	Display Output frequency at fault (Display ex.: When output frequency was 25.5Hz)
	Press [^] one time	FUNCTION DATA F2 60.0 ■Hz □r/min □A □s □V □%	Display set frequency at fault (Display ex.:When set frequency was 60Hz)
	Press [^] one time	FUNCTION DATA F3 123. □Hz □r/min ■A □s □V □%	Display output current at fault (Display ex.: When output current was 123A)
	Press [^] one time	FUNCTION DATA F4 1. rE □Hz □r/min □A □s □V □%	Display, in code, operation state at fault (Display ex.: When the rotation was reverse)
When F4 has been displayed, press [SHIFT] to switch to operation state retrieval mode.	Press [SHIFT] one time	FUNCTION DATA F4 1. rE □Hz □r/min □A □s □V □%	Switch to operation state retrieval mode. The function selection indicator will go out. No changes in other displays.
Press [^], and the state at operation will be displayed in code, Press [^] in turn until no display will appear.	Press [^] one time	FUNCTION DATA F4 2. UL □Hz □r/min □A □s □V □%	Change the contents of the display (Display ex.: When voltage limit was actuating)
	Press [^] one time	FUNCTION DATA F4 3.--- □Hz □r/min □A □s □V □%	No displays. The operation state retrieval has been completed.

When the retrieval on the fault history is not required, press [RESET]. By doing so, the protective function actuating will be cleared, and the monitoring operation mode on the indicator will switch to that preceding the occurrence of fault to get the operation ready.
When you retrieve the fault history, operate as following.

(3) Fault history retrieval

Procedures	Example of operation and display		
	Operation	Display	Description
Press [SHIFT] to select the 1st digit of Function.	Press [SHIFT] two times	FUNCTION DATA F43.--- □Hz □r/min □A □s □V □%	Example continued from (1) Select the first digit of Function.
When F5 is selected by press [^], only the fault which was the first display at the last occurrence of fault will be displayed in code. The 2nd and following faults retrieved will not be displayed.	Press [^] one time	FUNCTION DATA F5 OL2 □Hz □r/min □A □s □V □%	Display the class of the fault which was the first display when the last fault occurred (Display ex.: When electronic thermal was actuating)
When F6 and F7 are selected by Press [^], the fault at the time back one time and two times respectively.	Press [^] one time	FUNCTION DATA F6 OC1 □Hz □r/min □A □s □V □%	Display the class of the fault which was the first display at the time preceding the last occurrence (Display ex.: When overcurrent protective function was actuating at accelerating)
At this stage, the retrieval for fault mode has been completed. Press [RESET] after solving the problems and turning off the run command. By doing so, the protective function actuating will be cleared, and the monitoring mode on the indicator will switch to that preceding the occurrence of the fault to get the operation ready.	Press [^] one time	FUNCTION DATA F7 ---- □Hz □r/min □A □s □V □%	Display the class of the fault which was the fast display at the time back two times since the last occurrence (Display ex.: When fault data has not been input.)
	Press [RESET]	FUNCTION DATA 00 00 ■Hz □r/min □A □s □V □%	Complete fault monitoring operation, and display the parameters which had been monitorerd before the fault occurred. (Display ex.: When monitoring out put frequency)

NOTE:

① **The 2nd digit of Function cannot be modified during fault display. On the other hand, the 1st digit can be selected for fault-detail retrieval.**
② **Reset command can be input by using RESET or alarm reset input terminal.**
③ **When reset command is input, the erasing of the data display at fault and the moving-up of a fault history will be executed.**
Note that the second and following faults have not been stored in the memory.
It is recommended to record these datas in view of the future operation and maintenance.
④ **Retrieval when no fault has occurred**
Set the code (number) of an item to be retrieved with SHIFT, ∧ and ∨. For Functions F0 - F4 ,however, because there are no fault inputs, the displays are: - - - - on the data indicator, and F1 ,F2 : ■ Hz, and F3 : ■ A lighting on the unit indicator, while F0 and F4 do not light. When F5 - F7 have been selected, each of fault histories will be displayed on the data display.
⑤ **When fault mode has been selected in the state of no faults to retrieve such as a fault history and then RESET is pressed, the mode will not execute the moving-up of the fault history.**
When the control power supply is turned off during fault display, fault output signal will not be held.
Furthermore, note that, after the control power supply has been turned off, if it is turned on again without eliminating the cause of the fault, that will be detected as a new fault.
⑥ **To reset inverter turn off all start signals (FWD, REV), and press RESET key.**

7. Trial operation

7-1 Preparation for operation

Don't fail to check the following items before trial operation.
① Is the input AC power supply complied with the ratings?
200V series: 3-phase 3-line, 220 to 230V/ 50Hz, 230V/ 60Hz
400V series: 3-phase 3-line, 400 to 420V/ 50Hz, 380 to 400V/ 50Hz, 400 to 460/ 60Hz
② Are the input and output of the main circuit connected in good order?
(Input source faling under L1, L2 and L3, Electric motor, U, V, and W)
③ Is the wiring of the main circuit and control circuit not in contact with the earthing or other terminals or not short-circuitted?
④ Is the panel mixed or attached with such foreign matters as metals and electric wire chips?
⑤ Are screws, connectors, terminals, etc. not loose?
⑥ Confirmation of the operation of the external sequence circuit

7-2 Trial operation

For safety's sake, disconnect the couplings and belts with which motors and machinery are connected to allow independent operation by motors. When operating with it directly connected with the machine, be careful not to cause danger.
① Set all operating switches to OFF.
② Set the frequency setter to the minimum value.
③ Put the wiring breaker (MCCB) to work
(control circuits and sequence circuits will be turned active), size up the situation for a while, and check to see if cooling fan is rotating normally and if nothing is found in the control circuit, sequence circuit, etc. (heating, fume, abnormal smell, etc.)
In this case, make sure that the "CHARGE" lamp of the front panel is on.
④ When (MCCB) is put to work, the data display part of the touch panel will display LoAd and flicker for a while.
This is because CPU is doing the reading action of the internal data.
After LoAd disappeared, it will set the parameter to check to see if the set data meet the specification.
How to check it is referred to in "6. Touch Panel. (Page 13 ~ 21)"
⑤ Give a forward or reverse command.
Check to see if the motor begins to rotate with the frequency setter turned righward a little.
Make sure that the rotating direction is correct in such condition.
The turning direction of the motor is counterclockwise looking from the driving side (shaft end) of the motor by the forward turning command.
When reversing the turning direction, set the operation signal to the reversing turning command. If forward and reverse turning commands should be put at the same time, the motor will come to a stop, for which care should be exercised.

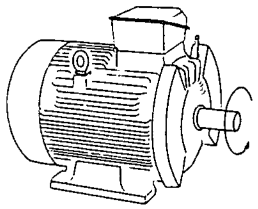


Fig. 8-2-1 forward turning direction of motor

⑥ Rise the frequency setter gradually and check to see if the inverter output frequency reaches the maximum frequency of the motor.
The maximum frequency of the inverter has been set to 60Hz at shipment.

⑦ After confirmation has been finished, stop it once, set the frequency setter a little higher, and check to see if acceleration and deceleration is made smoothly.
With this, the trial operation comes to an end.
Make operation with the load combined.
If the setting should be changed as a result of the trial operation, follow the procedures described in "6. Touch Panel."

NOTE: When FWD-CM or REV-CM terminals are connected, inverter does not start at power up, causing "OH2" trip. To start the inverter disconnect all the FWD-CM, and REV-CM connections, press RESET key, and make FWD-CM or REV-CM connection.

8. Operation

Make operation in accordance with the following procedures.
For the items not included absent in the following procedures though it is carried in the procedures of the trial operation, it is allowed to add procedures depending upon the circumstances.

(1) Put the power (MCCB) to work.
(2) Confirmation of "CHARGE" lamp of the front panel going on.
(3) When data are required to be changed, follow the procedures described in "6. Touch Panel"
(4) When a forward or reverse turning command is inputted, the motor will be operated at the setting frequency: provided. It will not be operated when the set frequency has been set below the starting frequency.
(5) When changing the contents of the display or data changeable of the setting in course of operation, follow the procedures described in "6. Touch Panel"
(6) Set the forward or reverse turning command terminal to "OFF", and the motor will be decelerated to stop.
Unless re-operation takes place immediately, stop the motor for safety and set the power to "OFF".

9. Maintenance and inspection

The inverter is composed of many parts.
Unless those parts operate properly, they will not develop their performance fully.
It is necessary to make good maintenance and inspection to prevent failure in the inverter beforehand and to keep on operation of good reliability.
Inspection methods should be refferred to "Inspection List 14" (page 66).

9-1 Cautions in course of maintenance and inspection

CAUTION: Do not conduct any inspections until disconnecting the power supply and the "CHARGE" lamp on the inverter has gone out.

9-2 Daily inspection

(1) Don't remove the cover, and check to see from outside if abnormal sound, smell, and damage are not perceived in accordance with the inspection items.
(2) Whenever abnormal phenomenon should be found, make sure of its place and extent without delay.
(3) Check the contents of the abnormality. If the operation is allowed to be kept on, record the abnormal details for referential data in case of a periodic inspection.

9-3 Periodic inspection

Remove the covers and check to see if nothing is found abnormal visually or by touch from the outside in accordance with the inspection list items. Don't fail to observe "Item No. 9-1 Cautions for Maintenance and Inspection." "inspection list 14." (page 66)

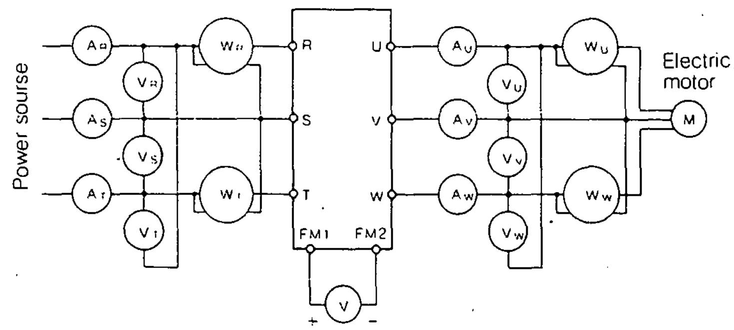
9-4 Periodic exchange of parts

Usually the life time of electrolytic capacitors are approximately five years and that of cooling fans are approximately three years, but the life times is different from this number of years in according to environment and working time per one day.
Please exchange these parts before occuring the troubles.

9-5 Measurement of main circuit electric capacity

Since the voltage and current of the input and output circuits of the inverter include harmonic wave, it is necessary to select the measuring instrument type.
When a measuring instrument for commercial frequency, measure it with the measuring instrument shown in Fig. 9-5.
For reference, the power factor will cause big errors by measuring a power factor meter because it will be subjected to change in the harmonic wave current and output frequency.
When the power factor is required, measure the voltage, current, and electric power and calculate it from the following equation.

$$\text{Power factor} = \frac{\text{Power(kW)}}{\sqrt{3} \times \text{Voltage(V)} \times \text{Current(A)}} \times 100\%$$



item	Input side measuring instrument (power side)			Output side measuring instrument (motor side)			Output frequency (Terminal FM1, FM2)
	Voltage wave form Current wave form			Voltage wave form Current wave form			
Name of measuring instrument	Amperemeter $A_{R,S,T}$	Voltmeter $V_{R,S,T}$	Wattmeter $W_{R,S,T}$	Amperemeter $A_{U,V,W}$	Voltmeter $V_{U,V,W}$	Wattmeter $W_{U,V,W}$	DC Voltmeter V
Kind of measuring instrument	Moving-iron type	Rectifier type or moving-iron type	Electrodyna-mometer type	Moving-iron type	Rectifier type	Electrodyna-mometer type	Movable coil type
Symbol of measuring instrument							

Fig. 9-5 Measurement of main circuit and measuring instrument

9-6 Confirmation of insulation

Insulation test has been made before delivery from the works.
It shall not be made as much as possible.
In an unavoidable case, follow the instructions below.
Wrong testing may damage the inverter, for which full attention must be paid.

CAUTION: Do not conduct megger tests between the inverter terminals or control circuit terminals.

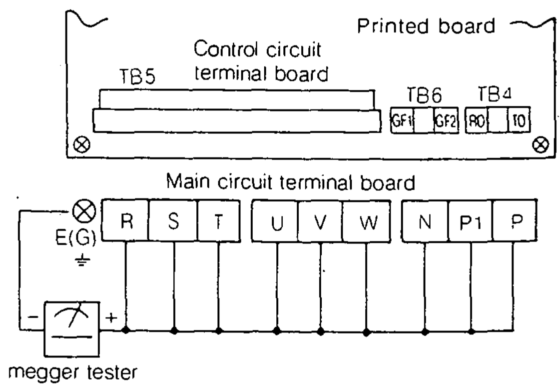


Fig. 9-6 How to megger test

(1) Main circuit
Make megger test (insulation resistance test) by using the following megger tester.
400V series: DC 500V megger
200V series: DC 250V megger
① Remove the external connections of all terminals (including control circuit terminals) of the inverter, clean each component, and connect all main circuit terminals with common wires as shown in Fig. 9-6.
② Make megger test only between main circuit common line and ground (grounding terminal GND (PE)).
③ If the megger pointer indicates 5MΩ and over, it proves normal.

(2) Control circuit
Remove the external connection of the control circuit terminal for earth conductivity test.
Use a high resistance range tester for the tester. Neither megger nor buzzer shall be used.

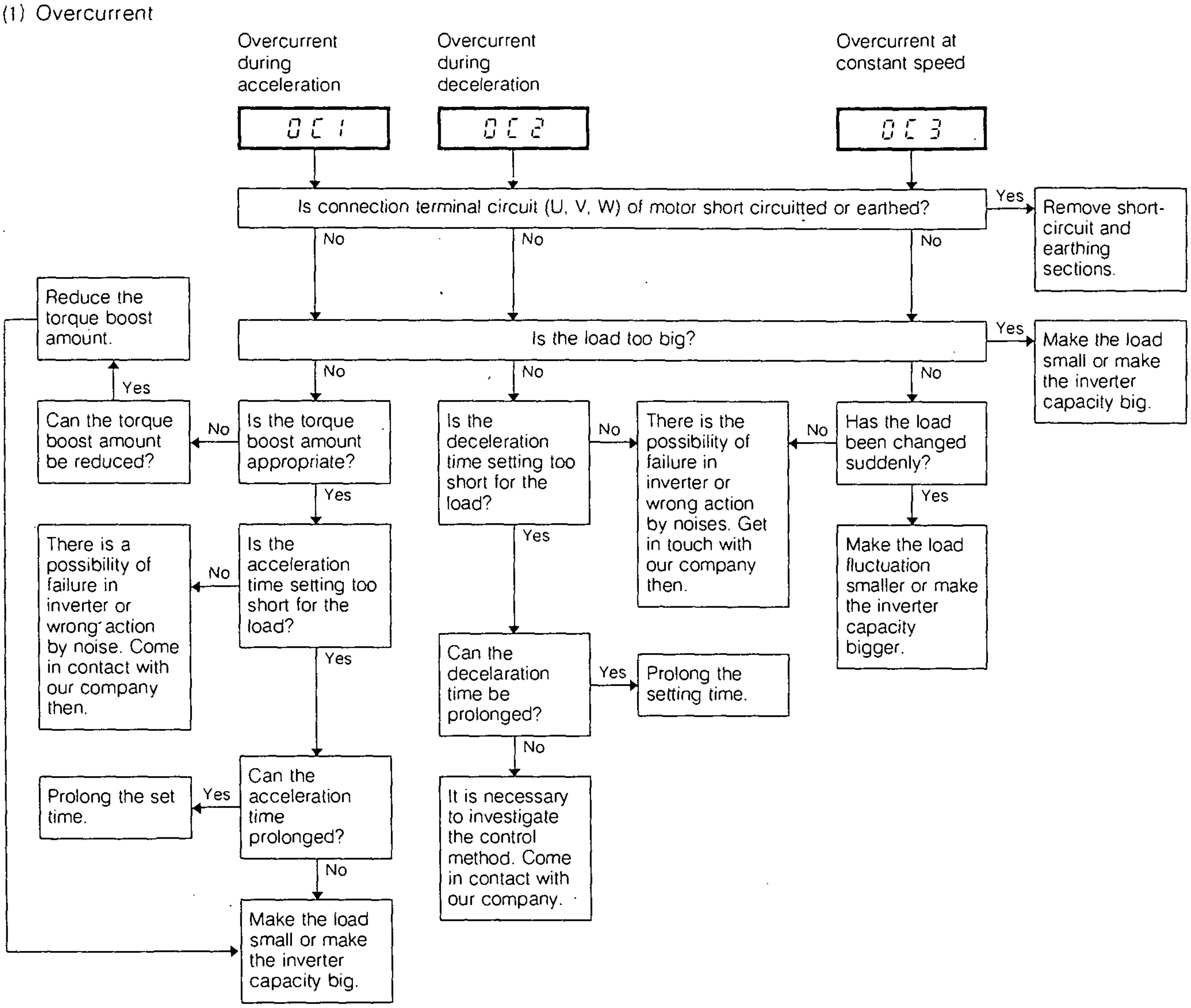
(3) Cautions for testing of external main circuits and sequence control circuits
When making a pressure test and megger test of external circuits, remove all terminals of the inverter so that the inverter may not be applied with the test voltage.

10. Troubleshooting

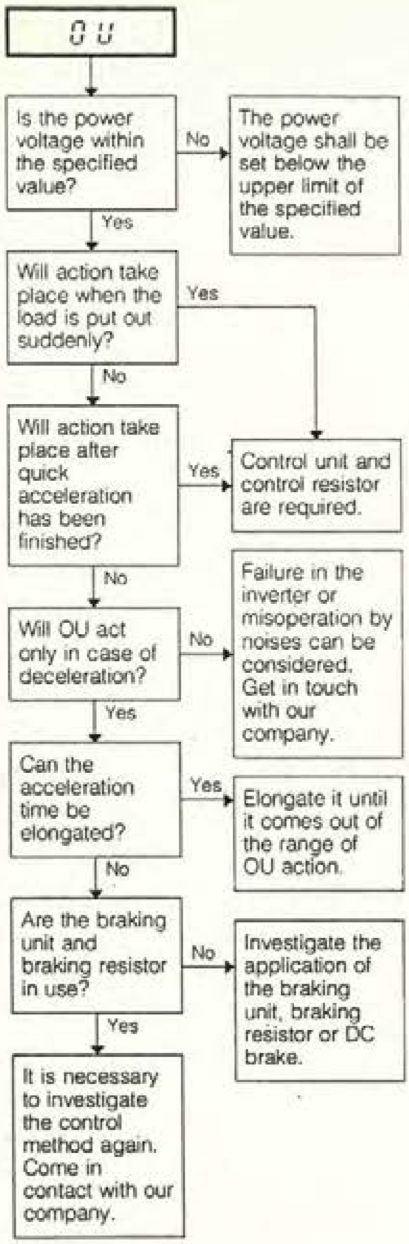
If the function of the inverter is lost by a failure or if an abnormal phenomenon occurred, refer to the following diagnosis and its cause must be pursued for remedy.
If it will not fall under the following explanation, if the inverter is damaged, and if its part was broken, or in case of trouble, please communicate the matter to the agent you bought it or your nearest Fuji sales office.

10-1 Diagnosis and remedy in case protection function made action indication

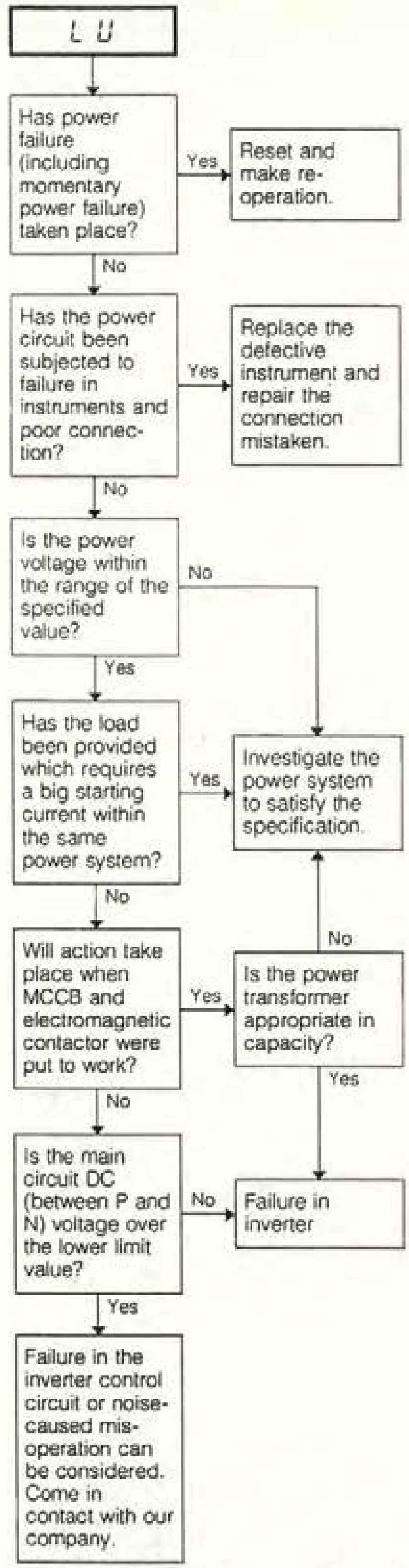
(1) Overcurrent



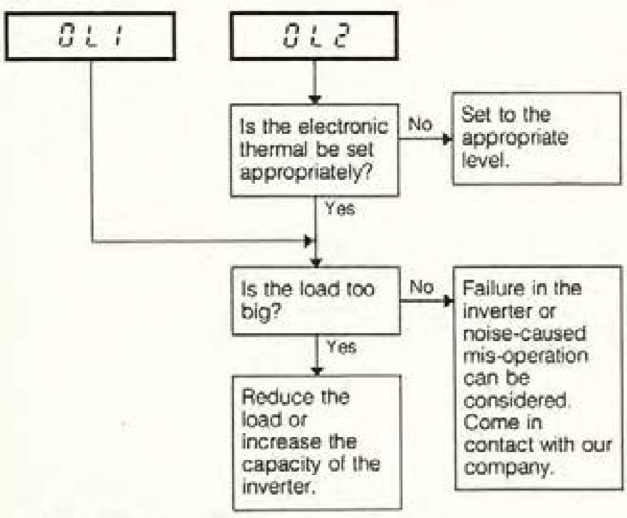
(2) Overvoltage



(3) Under-voltage



(4) Overload

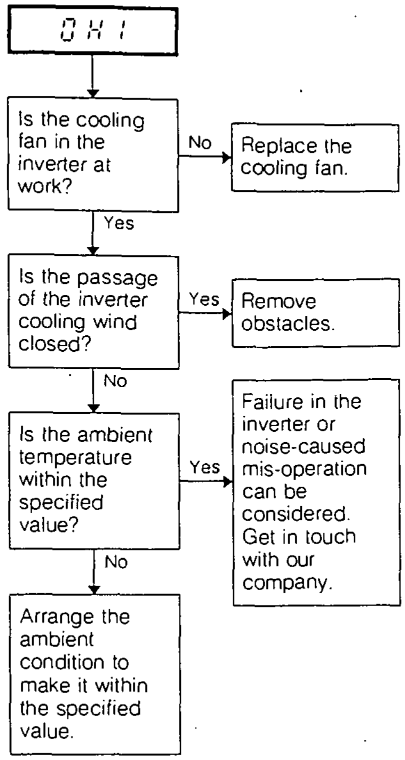


(note) OL1: Overload protection of inverter unit
(protection of main circuit equipment of Unit)
OL2: Overload protection of motor
(protection by electronic thermal)

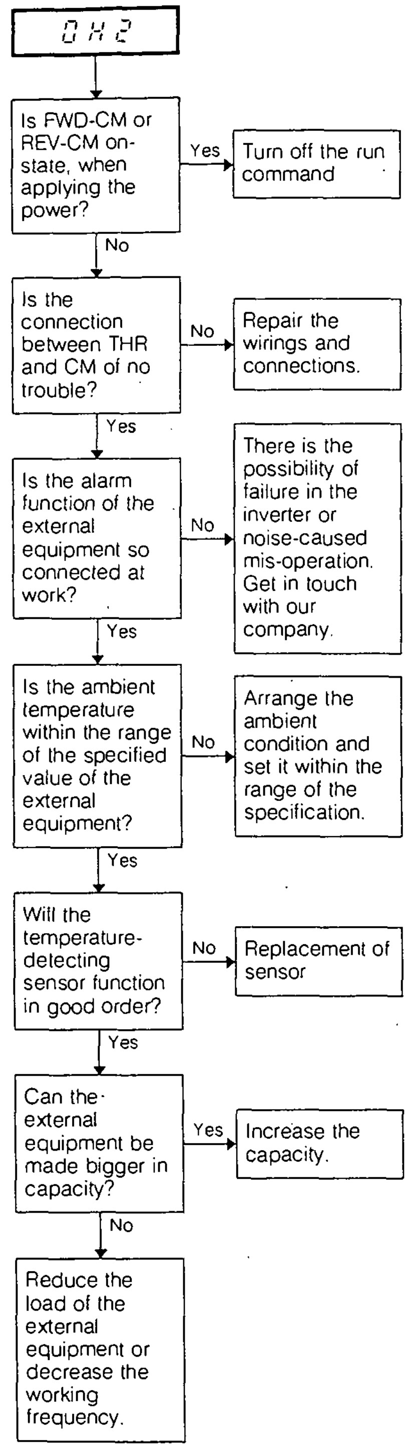
(Note 1) When the DC bus capacitor is discharged by power failure and the control power of the inverter is reduced, automatic resetting will take place.
When the function 43 is selected, no resetting is required. After the power is restored, automatic restart will begin.

(Note 2) Undervoltage will detect the main circuit DC voltage of the inverter, and display and alarm will take place.
When the voltage comes over the following range, display and alarm will take place.
∗200v series: DC 200V
∗400v series: DC 400V

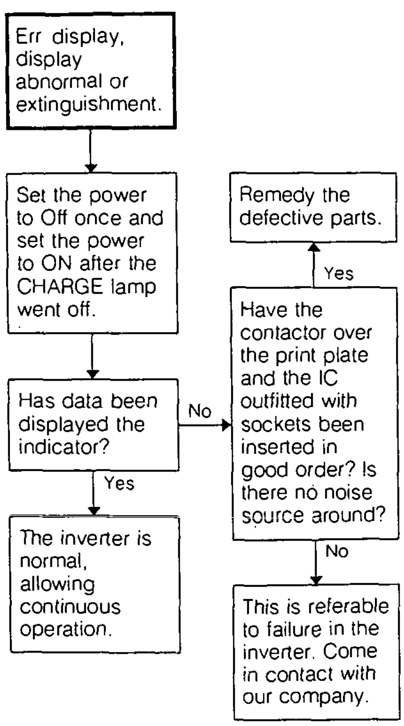
(5) Inverter overheat



(6) External failure and miss operation

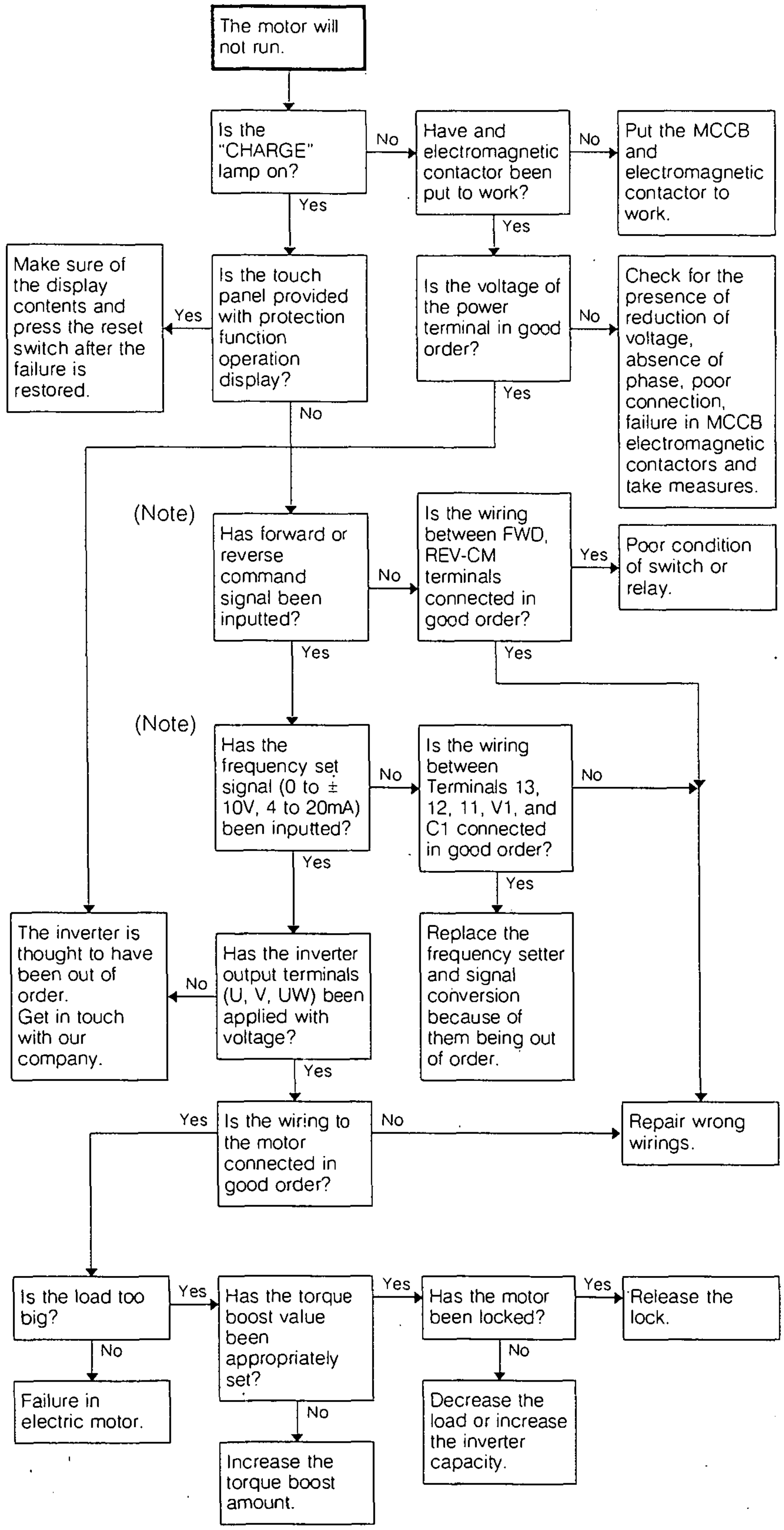


(7) CPU abnormal



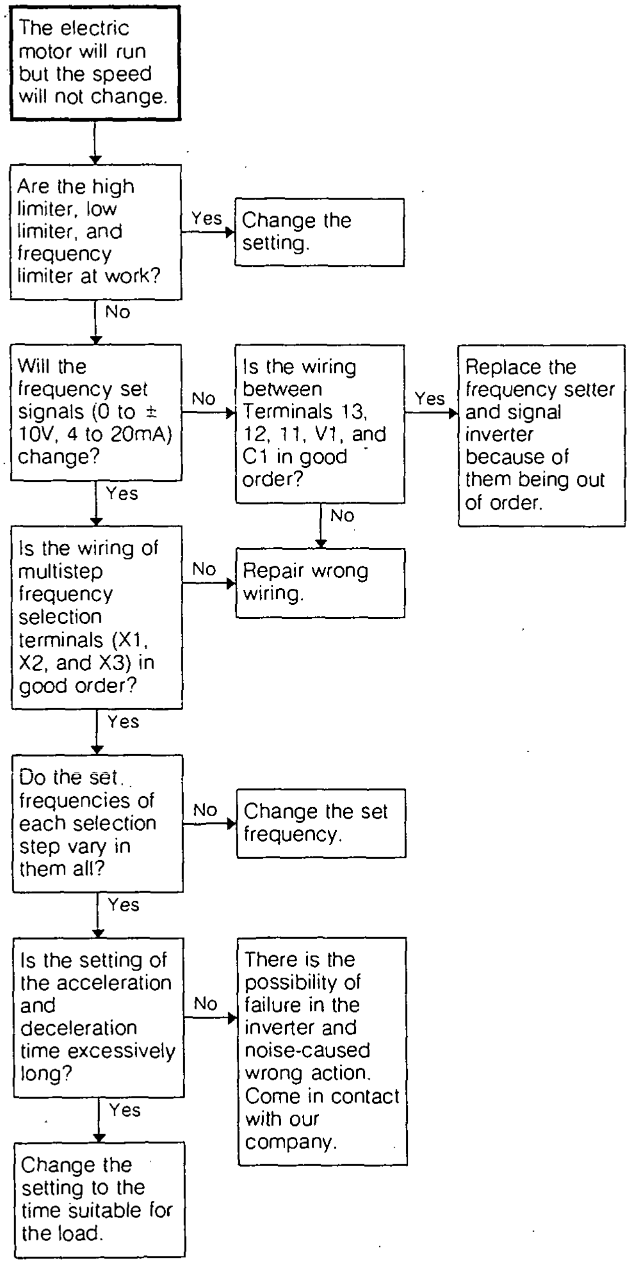
10-2 Diagnosis and remedy for abnormal phenomena

(1) Motor will not run.

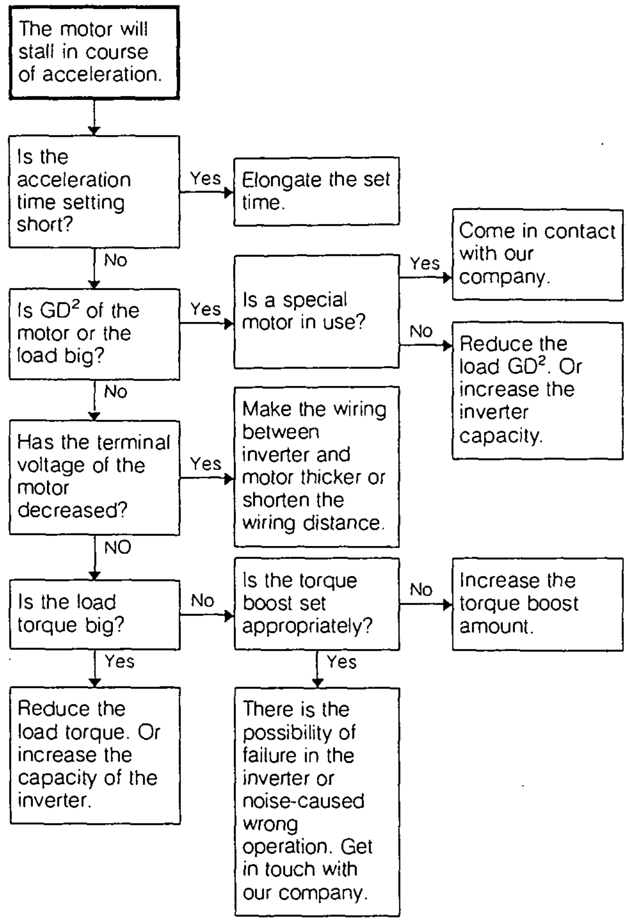


(Note)
Presence of forward and reverse commands and frequency set signal can be checked easily with the operation monitor function of 05 selected.
(Refer to Item No. 11-3, Operation Monitor page36)

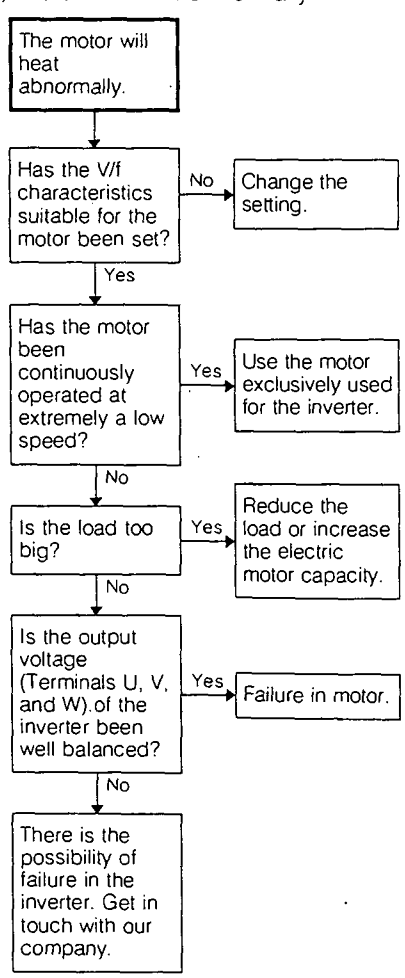
(2) Motor will run but speed will not change.



(3) Motor will stall in course of acceleration.



(4) Motor will heat abnormally



11. Inverter specification

11-1 Standard specification

(1) Individual specification

① FRENIC 5000G7 series

Voltage		200V series				400V series			
Applicable motor output [kW]		Inverter type	Rated capacity [kVA]	Rated output current [A]	Outbreak loss [kW]	Inverter type	Rated capacity [kVA]	Rated output current [A]	Outbreak loss [kW]
30		FRN030G7-2EX	44	115	1.3	FRN030G7-4EX	46	60	1.2
37		FRN037G7-2EX	55	145	1.6	FRN037G7-4EX	57	75	1.4
45		FRN045G7-2EX	69	180	2.0	FRN045G7-4EX	69	91	1.7
55		FRN055G7-2EX	82	215	2.3	FRN055G7-4EX	85	112	1.9
75		FRN075G7-2EX	108	283	3.1	FRN075G7-4EX	114	150	2.6
90		FRN090G7-2EX	132	346	3.7	FRN090G7-4EX	134	176	3.0
110		—	—	—	—	FRN110G7-4EX	160	210	3.3
132		—	—	—	—	FRN132G7-4EX	193	253	4.1
160		—	—	—	—	FRN160G7-4EX	232	304	5.0
200		—	—	—	—	FRN200G7-4EX	287	377	6.0
220		—	—	—	—	FRN220G7-4EX	316	415	6.8
Output Ratings	Rated output voltage (Note 1)	3-phase 3-wire system, 200 to 230V				3-phase 3-wire system, 380 to 460V			
	Rated output frequency (Note 2)	50 to 400Hz							
	Overload current rating	150%, for one minute (inverse time characteristics)							
Power	Rated input AC voltage	3-phase 3-wire system 220-230V/ 50Hz, 230V/ 60Hz				3-phase 3-wire 380-400V/ 50Hz (Note 3) 400-420V/50Hz 400-460V/ 60Hz			
	Allowable variation	Voltage: +10 to −15%, Imbalance: less than 3% (Note 4), Frequency: ±5%							

② FRENIC 5000P7 series

Voltage		200V series				400V series			
Applicable motor output [kW]		Inverter type	Rated capacity [kVA]	Rated output current [A]	Outbreak loss [kW]	Inverter type	Rated capacity [kVA]	Rated output current [A]	Outbreak loss [kW]
30		FRN030P7-2EX	44	115	1.3	FRN030P7-4EX	46	60	1.2
37		FRN037P7-2EX	55	145	1.6	FRN037P7-4EX	57	75	1.4
45		FRN045P7-2EX	69	180	2.0	FRN045P7-4EX	69	91	1.7
55		FRN055P7-2EX	82	215	2.3	FRN055P7-4EX	85	112	1.9
75		FRN075P7-2EX	108	283	3.1	FRN075P7-4EX	114	150	2.6
90		FRN090P7-2EX	132	346	3.7	FRN090P7-4EX	134	176	3.0
110		FRN110P7-2EX	158	415	4.4	FRN110P7-4EX	160	210	3.3
132		—	—	—	—	FRN132P7-4EX	193	253	4.1
160		—	—	—	—	FRN160P7-4EX	232	304	5.0
200		—	—	—	—	FRN200P7-4EX	287	377	6.0
220		—	—	—	—	FRN220P7-4EX	316	415	6.8
280		—	—	—	—	FRN280P7-4EX	400	520	8.2
Output Ratings	Rated output voltage (Note 1)	3-phase 3-wire system, 200 to 230V				3-phase 3-wire system, 380 to 460V			
	Rated output frequency (Note 2)	50 to 400Hz							
	Overload current rating.	120%, for one minute (inverse time characteristics)							
Power	Rated input AC voltage	3-phase 3-wire system 220-230V/ 50Hz, 230V/ 60Hz				3-phase 3-wire 380-400V/ 50Hz (Note 3) 400-420V/50Hz 400-460V/ 60Hz			
	Allowable variation	Voltage: +10 to −15%, Imbalance: less than 3% (Note 4), Frequency: ±5%							

(2) Common specification

Item			Specification		
Control	Control system		Sinusoidal PWM with flux control		
Control	Output frequency		0.5 to 400Hz (starting frequency 0.5 to 5.0Hz adjustable)		
Control	Frequency stability		Analog setting	±0.2% of maximum frequency (25±10℃)	
Control	Frequency stability		Digital setting	±0.01% of maximum frequency (−10℃ to +50℃)	
Control	Frequency resolution		Analog setting	±0.1% of maximum frequency	
Control	Frequency resolution		Digital setting	±0.1Hz (Option: 0.01Hz)	
Control	Voltage/ frequency characteristics (V/ f)		200V series	Voltage: 160 to 230V, Frequency: 50 to 400Hz	Available for continuous adjustment independently for both voltage and frequency
Control	Voltage/ frequency characteristics (V/ f)		400V series	Voltage: 320 to 460V, Frequency: 50 to 400Hz	
Control	Torque boost		21 selectable patterns and automatic energy saving mode		
Control	Acc/ Dec. time		Acceleration and deceleration time: 0.2 to 3600sec: linear: 4 patterns setting available; Non-linear acceleration and deceleration: 2 patterns setting avilable		
Control	Braking torque		Standard	Regenerative brake: 10 to 15%, DC braking: Starting frequency 0.0 to 60Hz, Time: 0 to 10 seconds, Voltage: 0 to 10%	
Control	Braking torque		Option	Dynamic brake: 100% (duty cycle 5%ED)	
Control	Standard functions		Torque limit control, automatic acceleration and deceleration, slip compensation control, current limiting, multistep frequency, up-down control, restart after instantaneous power failure, back up sequence from line to inverter, reversing operation with signal polarity, high or low limiter, bias frequency, and jump frequency		
Protection			Stall prevention, overcurrent, overvoltage, undervoltage (Note 6), instantaneous power failure, inverter overheat, inverter overload, motor overload (electronic thermal action), external failure (external thermal action, etc.), CPU error, output short circuit, ground fault for inverter protection (Option), and incoming surge		
Operation	Frequency setting input		Potentionmeter or voltage input: DC 0 to ±10V (DC 0 to ±5V), Current input: DC 4 to 20mA		
Operation	Input signal		Forward and stop command, reverse and stop command, 3-wire control, current signal input selection, multistep frequency selection, up-down control, acc/ dec time selection, coast-to-stop command, switching operation from line to inverter, interlock for load side switch, external alarm input, alarm reset input, and ground fault input		
Operation	External output signal		Relay output:	Power-side electromagnetic contactor command (NO), alarm (SPDT)	
Operation	External output signal		Open collector output:	Refer to "Auxiliary parameter setting, Function 45 (Page 49)"	
Indication	Frequency meter output signal		Analog: DC 0 to +10V, Pulse frequency: (6 to 100)×output frequency		
Indication	Touch panel LED indication	Running	Output frequency, reference frequency, motor synchronous speed, output current, output voltage, machine speed, and input and output signal check		
Indication	Touch panel LED indication	Setting	Function codes and data code indication (Refer to Function List.)		
Indication	Touch panel LED indication	Fault	OC : Overcurrent during Acc., OC2: Overcurrent during dec., OC3: Overcurrent during running at constant speed, OU : Overvoltage, LU : Undervoltage, OL1 :Inverter overload, OH1 : Inverter overheat, OL2: Motor overload, OH2 : External failure, Err0: CPU error and failure (8 points such as output frequency, etc.), failure history (three failure indications in past), etc.		
Indication	Charge lamp (LED indication)		DC intermediate circuit voltage		
Environment	Installation location		Indoors, altitude of 1000m and less, Do not install in a dusty location or expose to corrosive gases or direct sunlight.		
Environment	Ambient temperature		−10 to 50℃		
Environment	Humidity		20 to 90% RH (Non-condensing)		
Environment	Vibration		0.5G and less (conforming to JIS c 0911)		
Environment	Temperature during transportation		−25～+65℃		
Environment	Mounting		Panel mounting, external cooling type		
Protection system			Protection case attached unit (IP00: JEM1030, provided that if the applicable electric motor falls under 200 series, the unit of 75kW and less will be held optional and if the motor does under 400V series, the unit of 132kW and less will be held optional too, thus available for IP20.).		
Cooling system			Forced air-cooling		
Option			Ground fault detection unit for inverter protection (Note 7), relay output unit, touch panel extension cable set, Braking unit, Braking resistor, radio noise reducing zero-phase reactor, line side AC reactor, power factor improvement DC reactor, noise reducing AC reactor, frequency setter, frequency meter, and surge absorver		

(Note 1) The rated capacity falls under 220V for the 200V series and 440V for 400V ones in the rated output voltage.
(Note 2) Output voltage cannot exceed the power supply voltage.
(Note 3) Change the tap of auxiliary transformer when changing the power supply voltage from 380V to other voltages, and vice versa.
(Note 4) Use a line side AC reactor when imbalance in power supply voltage exceeds 3%.
Power supply voltage imbalance rate (%)=[Maximum voltage (V)]/ 3-phase mean voltage (V)×100
(Note 5) Following units are provided with DC reactors for power factor improvement as the standard outfitting (supplied other than units).
(1) G7 series: Inverter of 75kW and over (2) P7 series 200V series: Inverter of 75kW and over (3) P7 series 400V series: Inverter of 90kW and over
(Note 6) Even if the power is put out, operation can be kept on at 15ms or so at full load condition. (In case of light load operation, the operating time will be extended much more.) When the main circuit DC voltage comes below the under-voltage level, the inverter will stop the output without delay to hold tripped condition. However, when the control power of the inverter should come down, automatic resetting will take place.
(Note 7) The ground fault detection unit as an option is protect the inverter itself. Protection for human accident, fire, external equipment, etc. shall be provided with the leakage protecting device described separately.

11-2 Outline dimentions

Fig. A Inverter cooled inside switchboard

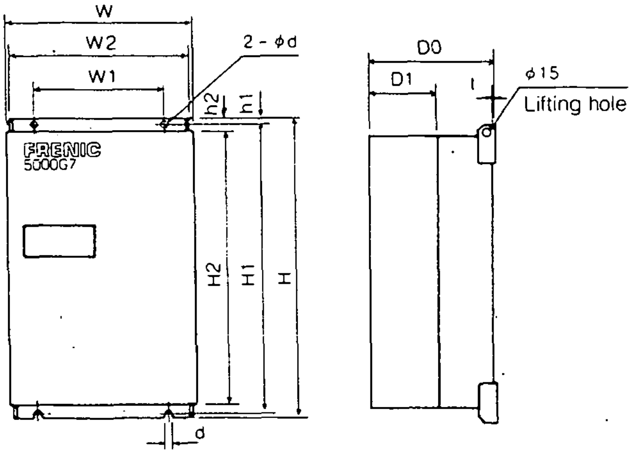
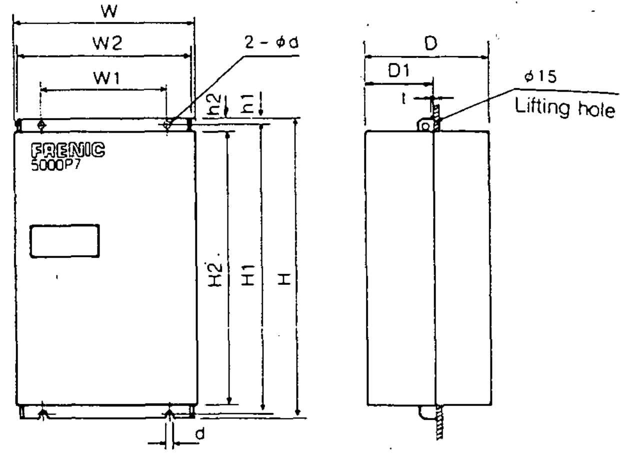
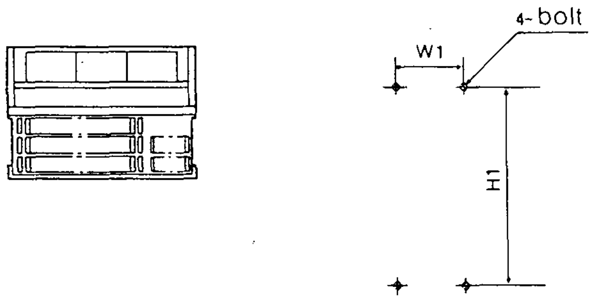


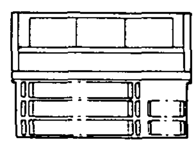
Fig. B Inverter cooled outside switchboard

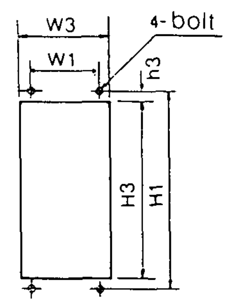


Panel drilling



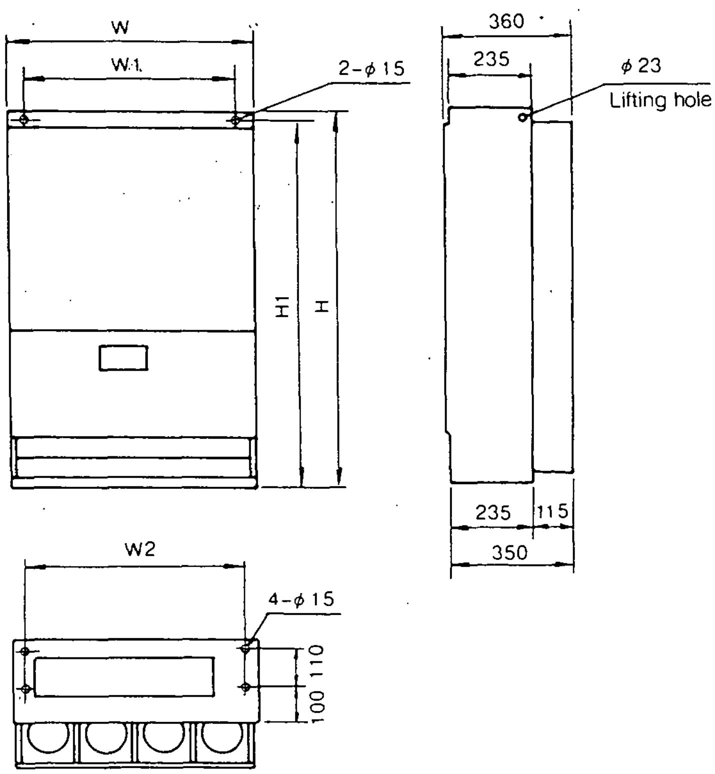
Panel cutting



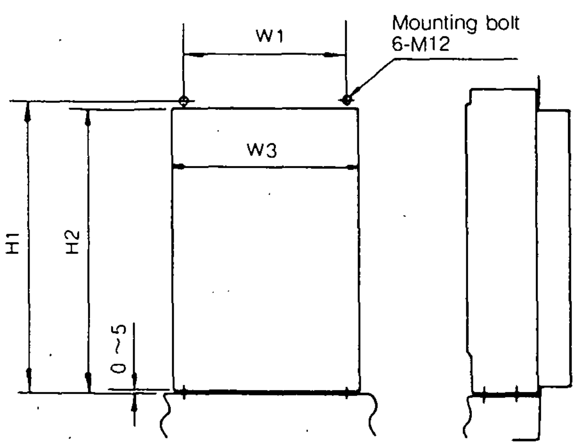


(Note) For inverter cooled outside switchboard the mounting adapter of the panel setting type inverter shall be removed and the mounting adapter shall be fitted on the prescribed position.

Fig.C Commen-use type



Panel cutting



200V series

Applicable motor [kW]	Inverter type		Fig.	Dimensions [mm]																Maunting bolt	Weight [kg]
	G7 series	P7 series		W	W1	W2	W3	H	H1	H2	H3	h1	h2	h3	D	D0	D1	t	d		
30	FRN030G7-2EX	FRN030P7-2EX	A,B	340	240	338	331	550	530	504	512	12	25	9	242	245	140	2	10	M8	30
37	FRN037G7-2EX	FRN037P7-2EX		375	275	373	366	615	596	570	578										40
45	—	FRN045P7-2EX		390	290	387	381	700	675	640	650	15	30	12.5					12	M10	45
	FRN045G7-2EX	—						800	775	740	750										53
55	FRN055G7-2EX	FRN055P7-2EX																			
75	FRN075G7-2EX	FRN075P7-2EX		540	440	537	530	750	720	685	695	18	35	12.5	257	260	140	3.2	15	M12	70
90	FRN090G7-2EX	FRN090P7-2EX	C	850	750	780	830	880	855	845	—	—	—	—	—	—	—	—	—		130
110	—	FRN110P7-2EX																			

400V series

Applicable motor [kW]	Inverter type		Fig.	Dimensions [mm]																Maunting bolt	Weight [kg]
	G7 series	P7 series		W	W1	W2	W3	H	H1	H2	H3	h1	h2	h3	D	D0	D1	t	d		
30	FRN030G7-4EX	FRN030P7-4EX	A, B	340	240	338	331	550	530	504	512	12	25	9	242	245	140	2	10	M8	30
37	—	FRN037P7-4EX																			32
	FRN037G7-4EX	—		375	275	373	366	615	596	570	578										35
45	FRN045G7-4EX	FRN045P7-4EX						675	656	630	638										43
55	FRN055G7-4EX	FRN055P7-4EX																			
75	—	FRN075P7-4EX		390	290	387	381	800	775	740	750	15	30	12.5	257	260			12	M10	56
	FRN075G7-4EX	—		530	430	527	520	880	850	815	825	18	35	12.5	312	315	175	3.2	15	M12	85
90	FRN090G7-4EX	FRN090P7-4EX																			
110	FRN110G7-4EX	FRN110P7-4EX																			95
132	—	FRN132P7-4EX						1050	1020	985	995				327	330	190				100
	FRN132G7-4EX	—																			105
160	FRN160G7-4EX	FRN160P7-4EX	C	680	580	610	660	1050	1025	1015	—	—	—	—	—	—	—	—	—		135
200	—	FRN200P7-4EX																			
	FRN200G7-4EX	—		850	750	780	830														170
220	FRN220G7-4EX	FRN220P7-4EX																			
280	—	FRN280P7-4EX																			

11-3 Functions

FUNCTION TABLE

Function				Data			
	Code	Name of function	Symbol	Setting range	Display	Minimum unit	Factory setting
Display	00	Output frequency		Indicate operating condition	Hz	0.1Hz	—
	01	Reference frequency (Preset frequency)			Hz	0.1Hz	—
	02	Motor synchronus speed			r/min	1r/min *1	—
	03	Output current			A	1A	—
	04	Output voltage			V	2V (1V) *2	—
	05	Machine speed			r/min	1r/min	—
	06	Input-signal status (checking)			—	—	—
	07	Output-signal status (checking)			—	—	—
	08	Torque limiting level for driving			%	1%	—
	09	Torque limiting level for braking			%	1%	—
	0A	Torque calculation value			%	1%	—
	0b	For option PC board					—
Fundamental parameter	10	Maximum frequency	F_{MAX}	50.0-400.0	Hz	0.1Hz	50.0Hz
	11	Base frequency	F_{BASE}	50-400	Hz	1Hz	50Hz
	12	Maximum output voltage	V_{MAX}	320-460 (160-230) *2	V	1V	380 (220)V *2
	13	Bias frequency		0-400	Hz	1Hz	0Hz
	14	High limiter	F_{HL}	0-400	Hz	1Hz	50Hz
	15	Low limiter	F_{LL}	0-400	Hz	1Hz	0Hz
	16	Acceleration time 1	ACC1	0.2-3,600	s	0.1s *3	20.0s
	17	Deceleration time 1	DEC1	0.2-3,600	s	0.1s *3	20.0s
	18	Gain for frequency setting signal	GAIN	0-200.0	%	0.1%	105.0%
	19	Torque boost		C-0 to C-20	—	—	C-3
	1A	Autmatic energy-saving operation		Active/ inactive	—	—	Inactive
	1b	Electronic thermal overload relay		0 (not in use), 50-105	%	1%	105%
Auxiliary parameter	20	DC brake starting frequency	F_{DCB}	0.0-60.0	Hz	0.1Hz	0.0Hz
	21	DC brake voltage	V_{DCB}	0.0-10.0	%	0.1%	10.0%
	22	DC braking time	T_{DCB}	0.0-10.0	s	0.1s	0.5s
	23	Multistep frequency setting 1	MSS1	0.0, 0.5-400.0	Hz	0.1Hz	0.0Hz
	24	Multistep frequency setting 2	MSS2	0.0, 0.5-400.0	Hz	0.1Hz	0.0Hz
	25	Multistep frequency setting 3	MSS3	0.0, 0.5-400.0	Hz	0.1Hz	0.0Hz
	26	Multistep frequency setting 4	MSS4	0.0, 0.5-400.0	Hz	0.1Hz	0.0Hz
	27	Multistep frequency setting 5	MSS5	0.0, 0.5-400.0	Hz	0.1Hz	0.0Hz
	28	Multistep frequency setting 6	MSS6	0.0, 0.5-400.0	Hz	0.1Hz	0.0Hz
	29	Multistep frequency setting 7	MSS7	0.0, 0.5-400.0	Hz	0.1Hz	0.0Hz
	2A	Acceleration time 2	ACC2	0.2-3,600	s	0.1s *3	100s
	2b	Deceleration time 2	DEC2	0.2-3,600	s	0.1s *3	100s
	2C	Acceleration time 3	ACC3	0.2-3,600	s	0.1s *3	100s
	2d	Deceleration time 3	DEC3	0.2-3,600	s	0.1s *3	100s
	2E	Acceleration time 4	ACC4	0.2-3,600	s	0.1s *3	100s
	2F	Deceleration time 4	DEC4	0.2-3,600	s	0.1s *3	100s
	30	Accel./decel.pattern		C--0, C--1, C--2	—	—	C--0
	31	Motor noise reduction		C--1, C--2, C--3, C--4	—	—	C--1
	32	Overload early warning signal	OL	50-105	%	1%	105%
	33	Torque limiter (Driving mode)	T_{DL}	-,20-180 (20-150) *4	%	1%	150 (120)% *4
	34	Torque limiter (Braking mode)	T_{BL}	0,20-180 (20-150) *4	%	1%	100%
	35	Frequency level detection	FDT	1-400	Hz	1Hz	30Hz
	36	Frequency equivalence detection range	FAR	0.5-5.0	Hz	0.1Hz	2.5Hz
	37	Starting frequency	F_{STA}	0.5-5.0	Hz	0.1Hz	0.5Hz
	38	Starting frequency holding time	T_{HOLD}	0.0-10.0	s	0.1s	0.0s
	39	Jump frequency 1	JUMP1	0.0, 0.5-400	Hz	0.1Hz	0.0Hz
	3A	Jump frequency 2	JUMP2	0.0, 0.5-400	Hz	0.1Hz	0.0Hz
	3b	Jump frequency 3	JUMP3	0.0, 0.5-400	Hz	0.1Hz	0.0Hz
	3C	Jump frequency range		(±)0.0-5.0	Hz	0.1Hz	2.0Hz
	3d	Number of motor poles	POLE	2,4,6,8,10,12	pole	2	4
	3E	Machine speed conversion coefficient		0.1-10.0	—	0.1	1.0

Function	Code	Name of function	Symbol	Data: Setting range	Display	Minimum unit	Factory setting
Auxiliary parameter	40	Digital frequency monitor coefficient		6-100	—	1	30
	41	FWD/ REV command hold (3-wire control)		Active/ inactive	—	—	Inactive
	42	UP/ DOWN control		Active/ inactive	—	—	Inactive
	43	Restart after instantaneous power failure		Active/ inactive	—	—	Inactive
	44	Undervoltage alarm		Active/ inactive	—	—	Active
	45	Output signal code selection	SLIP	0,1,2	—	—	0
	46	Slip compensation control		0.0-2.5	Hz	0.1Hz	0.0Hz
	47	Reversing operation with signal polarity		Active/ inactive	—	—	Inactive
	50	Analog frequency meter calibration		70.0-105.0	%	0.1%	100.0%
	51	Analog ammeter calibration *7		50.0-200.0	%	0.1%	100.0%
	52	Correction of motor primary resistance		50-200	%	1%	100%
	60	For option PC board		See the instruction manual of the option PC board. When the option PC board does not installed, the inverter indicates '- - - -'			
	61						
	62						
	63						
	64						
	65						
	66						
	67						
	68						
	69						
	6A						
	70						
	71						
	72						
	73						
	74						
	75						
	76						
	77						
	78						
	79						
	99	Manufacturer use function			—	—	Inactive
Fault Indication	F0	Faults display			—	—	
	F1	Output frequency (When the first fault occurred)			Hz	0.1Hz	
	F2	Reference frequency (When the first fault occurred)			Hz	0.1Hz	
	F3	Output current (When the first fault occurred)			A	1A	
	F4	Operation mode (When the first fault occurred)			—	—	
	F5	Fault memory 1			—	—	
	F6	Fault memory 2			—	—	
	F7	Fault memory 3			—	—	

REMARKS
*1: When the displayed value exceeds 9999 rpm, the minimum unit becomes 10 rpm. (12000 → 1200)
*2: The values in brakets indicate 200V series.

NOTE: There is some possiblity that this Function set data is not 380V according to the country where this inverter is delivered. Please check this Function whether the motor specification is matched.

*3: When the setting values exceed 100sec, the minimum setting unit becomes 1sec.
*4: 20-180% for G7, 20-150% for P7.
*5: When a function is active or inactive, "o" or " - " is displayed respectively.
*6: The functions marked can be set during inverter operation.
*7: Option PC board is necessary.

OPERATION DATA (MONITOR)

0	0	Output frequency

This function displays an inverter output frequency [Hz].

0	1	Reference frequency (Preset frequency)

This function displays the reference frequncy set by a frequency setting potentiometer, a voltage signal input from V1 terminal, a current signal input from C1 terminal, multistep frequency setting 1 to 7 or Up-down control.

0	2	Motor synchronous speed.

This function displays the motor synchronous speed [r/min]calculated by the following formula.

$$\text{Motor synchronous speed} = \frac{120 \times \text{output frequency}}{\text{number of motor poles}} \text{ [r/min]}$$

- For displaying the motor synchronous speed correctly, set 3d (number of motor poles) correctly.
- Because the inverter display is only 4-digit, when the speed is higher than 9999 r/min, the display range is autmatically switched to 1/ 10 mode, and the decimal point disappears.
  Example: 1200 r/min → 1200. 12000 r/min → 1200

0	3	Output current

This function displays an effective value of inverter output current. Its accuracy is ±10%. When a correct output current is needed, use an ammeter.

0	4	Output voltage

This function displays an effective value of inverter output voltage. The display indicates a reference value.

0	5	Machine speed

This function displays the rotating speed of driven machine, The indicated value is calculated by the following formula,

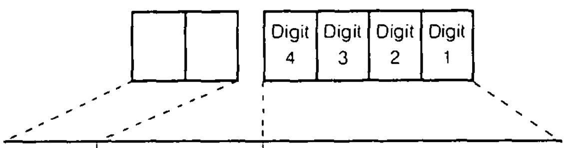
Machine speed [r/min] = Motor synchronous speed [r/min] × machine speed conversion coefficient

- The setting of Function 3E (auxiliary parameter), machine speed conversion coefficient (gear ratio, etc.), is required.
- Because the inverter display is only 4-digit, when the speed is higher than 9999 r/min, the display range is autmatically switched to 1/ 10 mode, and the decimal point disappears.
  Example: 1200 r/min → 1200. 12000 r/min → 1200

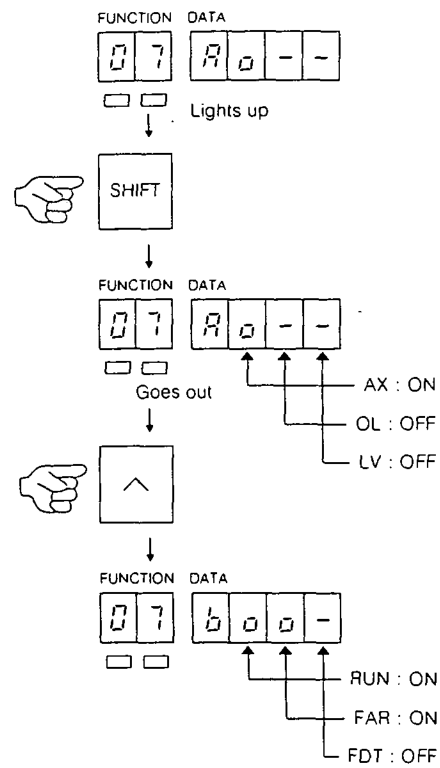
06	Input signal status

07	Output signal status

For an input/output signal check, use the UP/DOWN key to select function code 06 or 07 and press the SHIFT key.
The two LED lamps go out and data setting mode is set.
The input/output signal can be checked in this mode.
Check the signal by referring to the table and example.
The symbol "o" represents signal presence, and "-" signal absence.
Sequence checks can be made easily during operation.



Function code	Function	Data display 4-digit	3-digit	2-digit	1-digit
06	Input signal check	A	FWD	REV	BX
		b		THR	RST
		C	X1	X2	X3
		d	RT1	RT2	AUT
		E		IL	PU
07	Output signal check	A	AX	OL	LV
		b	RUN	FAR	FDT



08	Torque limiting level for driving

This function displays torque limiting level for driving [%] which is set on function 33.

09	Torque limiting level for braking

This function displays torque limiting level for braking [%] which is set on function 34.

0A	Torque calculation value

This function displays torque calculation value [%] of operating motor which is calculated from the inverter output voltage, current and the motor primary resistance.

BASIC PARAMETER DATA SETTING

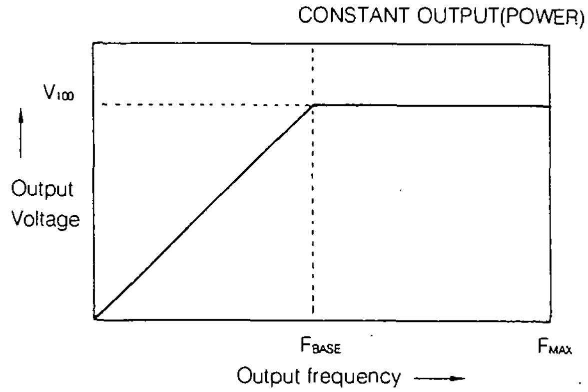
Function Code No.	10	11	12

V/F Pattern setting

These functions allow V/F pattern adjustment in order to tailor the maximum frequency, base frequency, and rated output voltage according to the rating of the motor and the application. Select a function code using the SHIFT and UP/DOWN keys. Shift the pointer to DATA SETTING MODE. Data has been set previously at the factory.
Change it with the UP/DOWN keys only when necessary and press the SET keys to store it.

Note: Data value blinks when changed using the UP/DOWN keys. Press the SET key to stop blinking. New value is now set.

FUNCTION	DATA	
10	60.0	F_{MAX} 50.0-400.0Hz
11	50.0	F_{BASE} 50-400Hz
12	400.0	V_{100} 320-460V (160-230V)



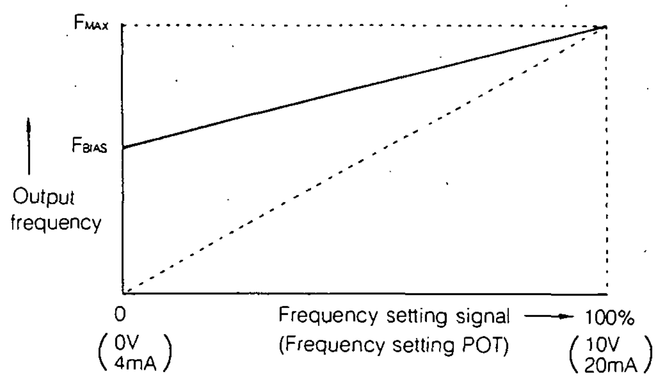
Function Code No.	13

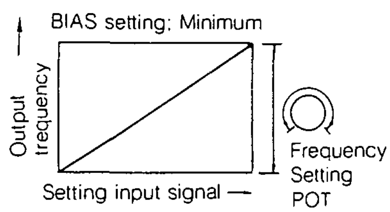
Bias setting

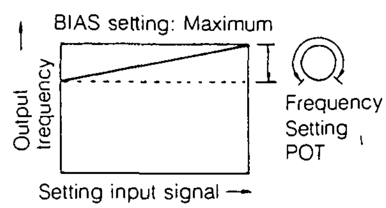
This function provides speed control using a process control signal (0 to 10VDC, 4 to 20 mA) or a frequency setting POT. The adjustable range is from 0 to 100% (F_{MAX}). When set at 100% an output frequency of 100% results even if the input signal is zero. However, when starting it begins with 0.5Hz irrespective of the setting.
Fine adjustment is possible if the bias is set at a high value.

FUNCTION	DATA	
13	0.0	F_{BIAS} 0-400

Note: The starting frequency is adjustable between 0Hz and 5Hz by setting the function code 37 (page 46).





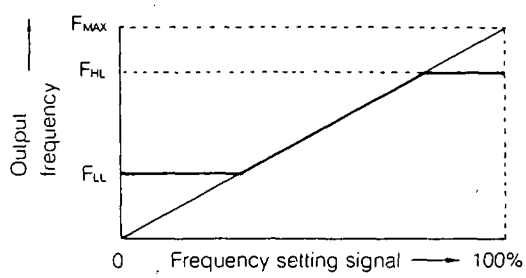


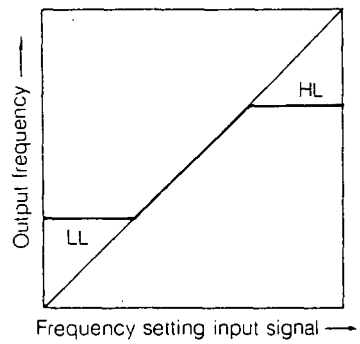
High or llow limiter

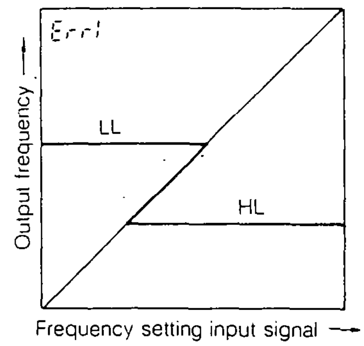
Function Code No. 14 15

These functions limit the output frequency to prevent the overspeed and underspeed operation of the motor.
For instance, the low limiter is used for control of the cooling water pump. This function is suitable for control in which the cooling water level is kept at the lowest allowable level even when the process signal is zero volt.

FUNCTION	DATA	
14	120.0	F_{HL} 0-400Hz
15	0.0	F_{LL} 0-400Hz







Note: When the setting value for HL is smaller than that for LL, the low limit value is ignored. At this time, "Err1" is displayed.

Acceleration and deceleration time

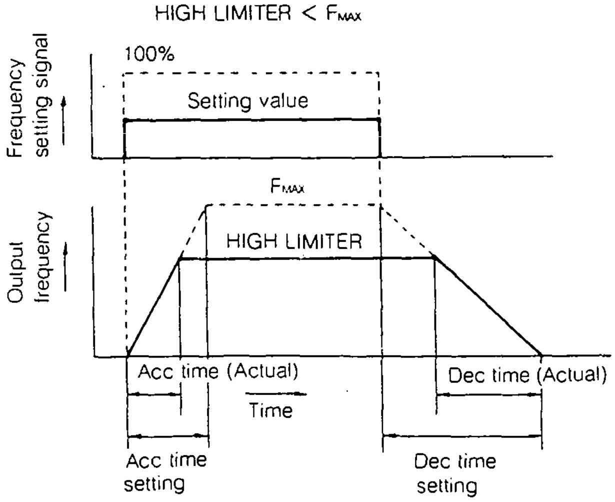
Function Code No. 16 17

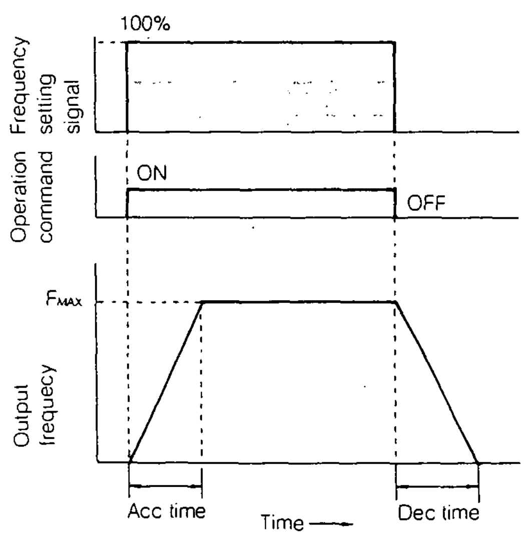
These functions set the acceleration and deceleration times. The acceleration time is the time it takes for the output frequency to incease from zero to F_{MAX}, and the deceleration time is the time it takes for the output frequency to decrease from F_{MAX} to zero. The time setting range is from 0.2 to 3600sec.

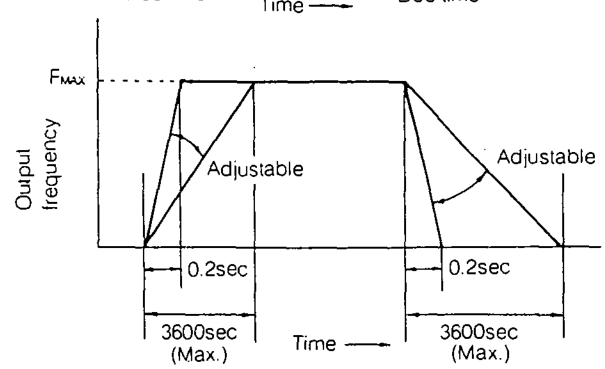
FUNCTION	DATA	
16	20.0	ACC1 0.2-3600sec.
17	20.0	DEC1 0.2-3600sec

Note: When the setting values exceed 100 sec, the minimum setting

HIGH LIMITER < F_{MAX}





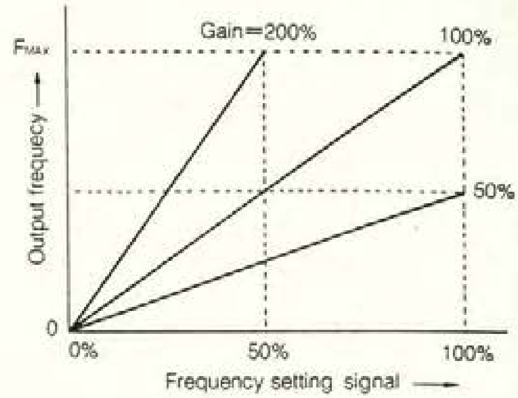


■ Gain for frequency setting signal

Function Code No. 18

This gain adjustment function is used for compensation when the input signal voltage is below 10V The adjustable range of the gain is from 0 to 200%. For example, if the frequency setting gain is set at 200%, the range from 0 to F_{MAX} can be controlled by compensation even when the input signal level is 5V DC.

FUNCTION	DATA	
18	105.0	GAIN 0-200.0%

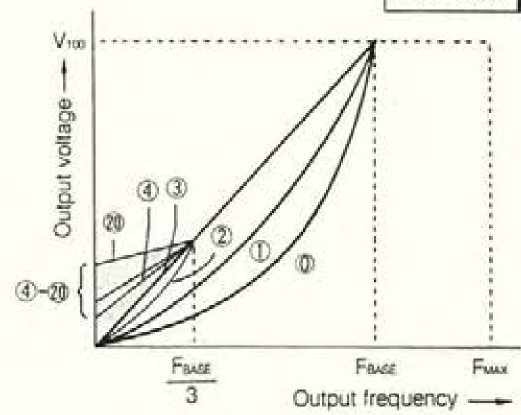


■ Torque boost

Function Code No. 19

This function boosts torque during low-speed operation. A torque boost pattern can be selected from 21 types according to the load and/or motor requirements. Patterns ⓪ and ① are suitable for variable torque loads such as a fan or a pump. When the pattern is ④ or higher, the voltage is increased and the torque is boosted in the range up to $F_{BASE}/3$.

FUNCTION	DATA	
19	C--3	Torque boost 0-20

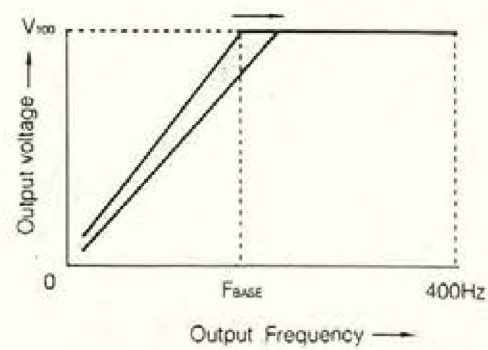


■ Automatic energy-saving operation

Function Code No. 1A

This function is for energy-saving operation. Energy is saved by reducing the voltage according to the load current.

FUNCTION	DATA	
1A	-	Active: o Inactive: -



Function Code No.

Electronic thermal overload relay

The inverter has a built-in electronic thermal overload relay. No external overload relay is necessary when a single motor (4-pole) is connected to a single inverter and the function is set according to the motor characteristics. Generally, the cooling effect of a motor is not sufficient during low-speed operation. The electronic thermal overload relay provides corrected characteristics.

For several motors connected to a single inverter, external thermal overload relays are needed for each motor feeder for individual protection.

For multiple motor applications, data code should be set to 0 (zero).

FUNCTION	DATA	
1 b	1 0 5.	0 (Inactive) 50-105%

Fig. 2 Inverter current characteristics

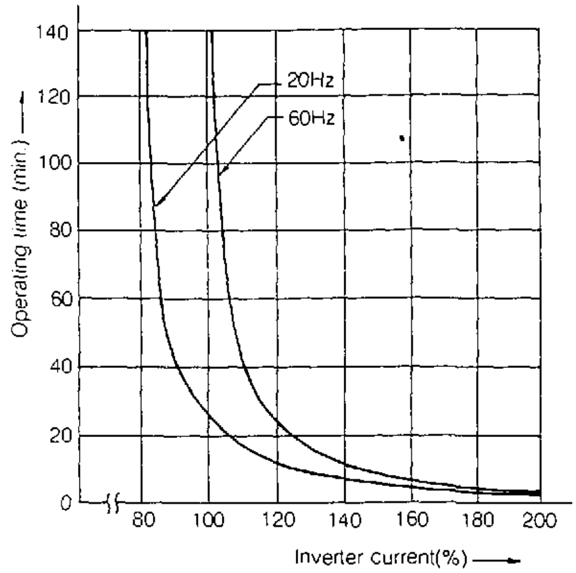
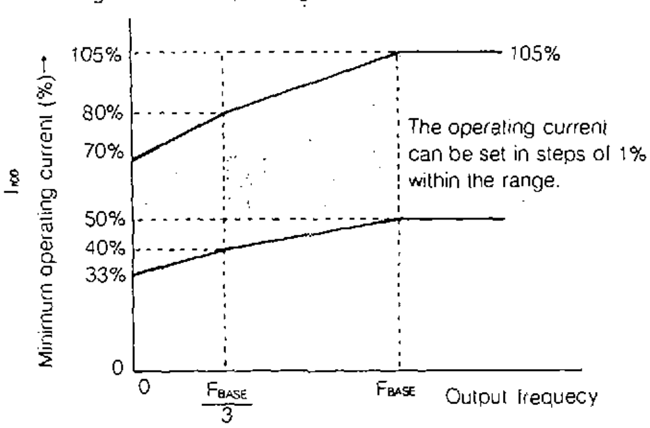


Fig.1 Minimum operating current characteristics



- Setting the electronic thermal overload relay

The setting current is obtained by using the following formula.

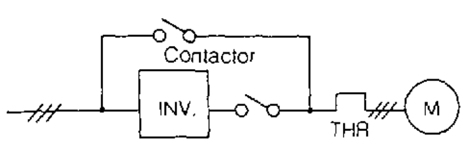
$$I_{100}(\%) \leq \frac{\text{Motor rated current}}{\text{Inverter rated current}} \times 100\%$$

Example: Motor full load current: 56A
Inverter rated current: 91A
(FRN045G7-4EX)

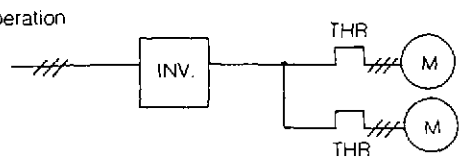
$$I_{100}(\%) = \frac{56}{91} \times 100(\%) = 61(\%)$$

Data code should be set 61.

- Line operation ⟷ Inverter operation

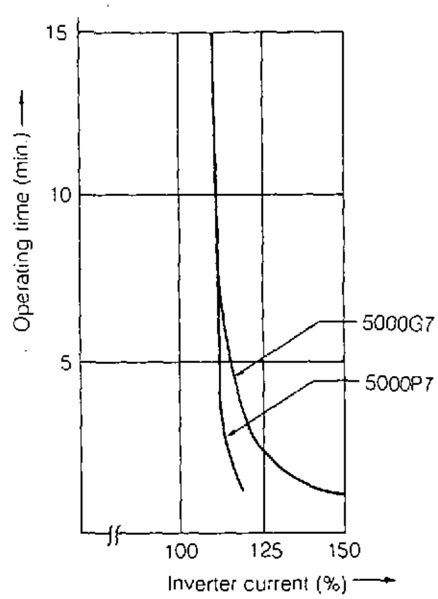


- Group operation



3-element heater

Fig.3 Inverter overload



Note.

These electronic thermal overload relays meet the requirements of 4-pole standard motors.

Therefore, under the following conditions, use a conventional overload relay in place of the electronic type.

1. When used with motors other than 4-pole type.
2. When used with special motors (non-standard motors).
3. When used for a group operation (in which two or more motors are run by using a single inverter).
4. When frequent starting can be expected.

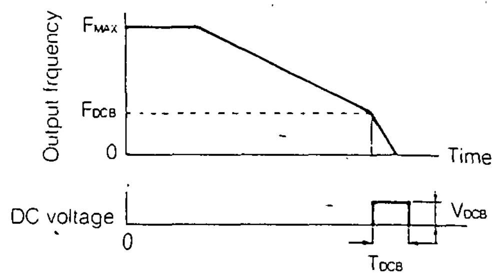
(4) AUXILIARY PARAMETER SETTING FUNCTION

DC braking

Function Code No. 20 21 22

These functions are used for DC braking to stop the motor. If the braking time exceeds 10sec., the motor enters the coast-to-stop state.

DC braking start frequency F_{DCB} : 0.0 to 60Hz
DC braking voltage frequency V_{DCB} : 0 to 10%
DC braking time T_{DCB} : 0 to 10sec
Braking duty : 5% ED or less



FUNCTION 20 DATA 0.0
F_{DCB} 0.0 to 60Hz

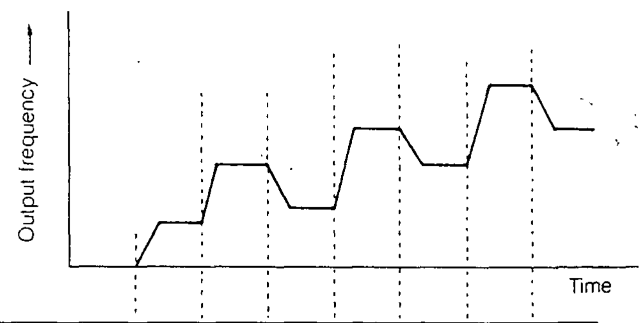
FUNCTION 21 DATA 10.0
V_{DCB} 0 to 10.0%

FUNCTION 22 DATA 0.5
T_{DCB} 0 to 10.0sec

Multistep frequency setting

Function Code No. 23 TO 29

Seven different frequencies can be set by turning on and off the external contact signals (at X1-CM, X2-CM, X3-CM terminal groups). The frequency setting range for each step is from 0.5 to 400Hz. The ramp time for each step is determined by the acceleration and deceleration time settings.



Terminals		MSS1	MSS2	MSS3	MSS4	MSS5	MSS6	MSS7
X1-CM	○	●	○	●	○	●	○	●
X2-CM	○	○	●	●	○	○	●	●
X3-CM	○	○	○	○	●	●	●	●

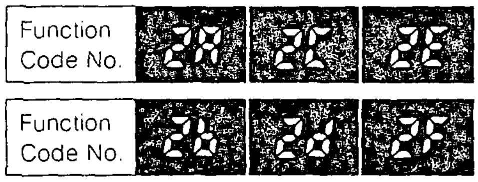
● : ON
○ : OFF

Multi-frequency setting

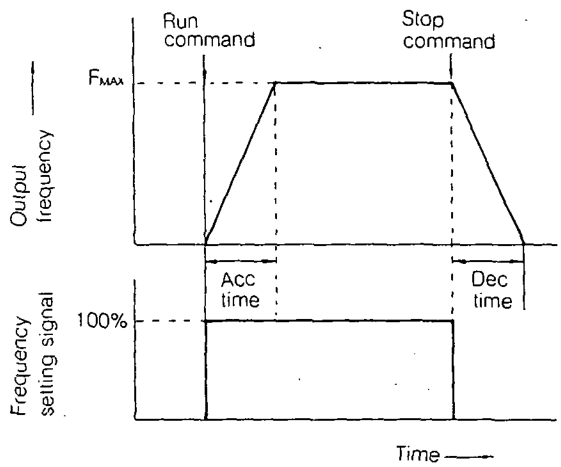
FUNCTION	DATA	
23	5.0	MSS1 0.0, 0.5 to 400.0Hz
24	10.0	MSS2 0.0, 0.5 to 400.0Hz
25	20.0	MSS3 0.0, 0.5 to 400.0Hz
26	30.0	MSS4 0.0, 0.5 to 400.0Hz
27	40.0	MSS5 0.0, 0.5 to 400.0Hz
28	50.0	MSS6 0.0, 0.5 to 400.0Hz
29	60.0	MSS7 0.0, 0.5 to 400.0Hz

Acceleration/deceleration time setting

The time of acceleration from 0 to F_{MAX} and the time of deceleration from F_{MAX} to 0 can be set from 0.2 to 3600sec. Four different acceleration and deceleration times (including acceleration time 1 and deceleration time 1) can be set by combinations of external control signals (at RT1-CM and RT2-CM terminal groups).



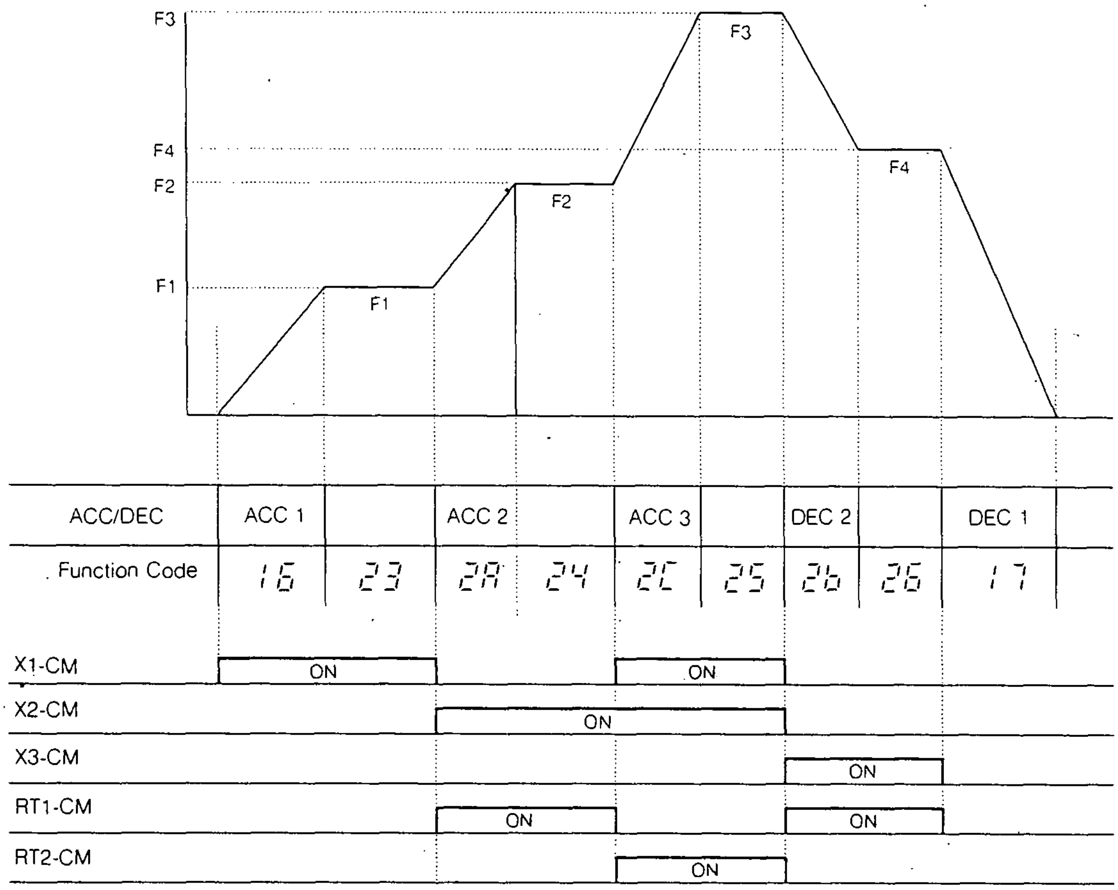
FUNCTION	DATA	
2A	100.0	ACC2 0.2-3600sec
2b	100.0	DEC2 0.2-3600sec
2C	100.0	ACC3 0.2-3600sec
2d	100.0	DEC3 0.2-3600sec
2E	100.0	ACC4 0.2-3600sec
2F	100.0	DEC4 0.2-3600sec



Treminals	ACC/DEC1	ACC/DEC2	ACC/DEC3	ACC/DEC4
RT1-CM	○	●	○	●
RT2-CM	○	○	●	●

● : ON ○ : OFF

Multistep frequency control (example)



■ Accelereation and deceleration pattern

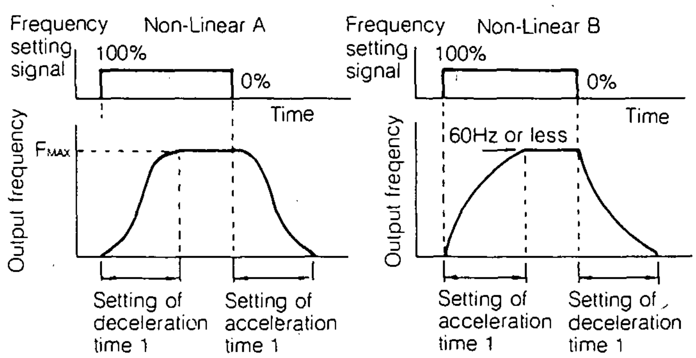
Function Code No. 30

This function allows selection of non-linear acceleration and deceleration. Pattern A is suitable for machine loads where quick changes in accelertion and deceleration are undesirable. Patteren B is more suitabe for fan and blower.
- Further information: see next page

Note: 1) Linear pattern will override pattern B if F_{MAX} is greater than 60Hz.
2) This function cannot be used in the event the multistep frequency selection is made

Pattern	Setting
Linear ACC/DEC.	C--0
Non-Linear A	C--1
Non-Linear B	C--2

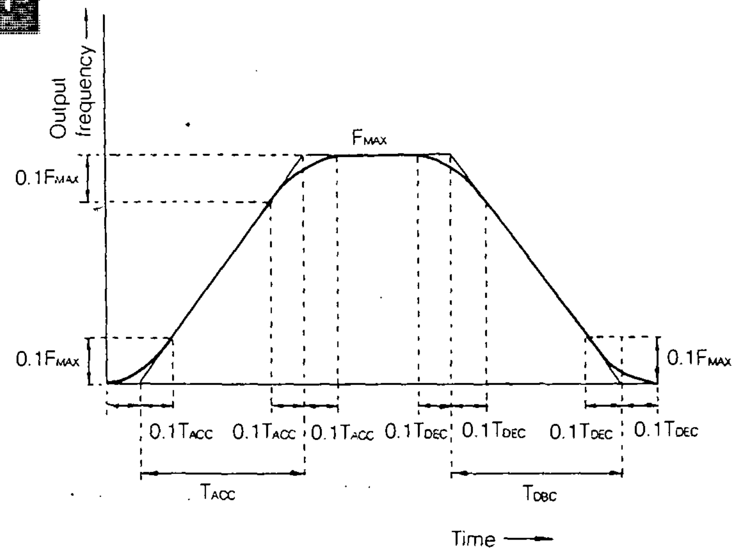
FUNCTION: 3 0 DATA: C - - 0 0, 1, 2



The gradient of non-linear acceleration and deceleration is obtained with following methods.

Non-linear pattern A

- T_{ACC} : Preset acceleration time
- T_{DEC} : Preset deceleration time
- The actual time from the start of acceleration / deceleration to the time when the reference frequency is reached is 1.2 times the preset acceleration/ deceleration time.
- If the change width of the frequency setting is less than 20% of the maximum frequency (F_{MAX}), the acceleration/deceleration pattern may be linear.



Non-linear pattern B

- Non-linear pattern B consists of four line segments each for acceleration and deceleration.

$$T_1 = T_{ACC} \times \frac{29}{109 + \alpha} \qquad T_5 = T_{DEC} \times \frac{\beta}{335 + \beta}$$

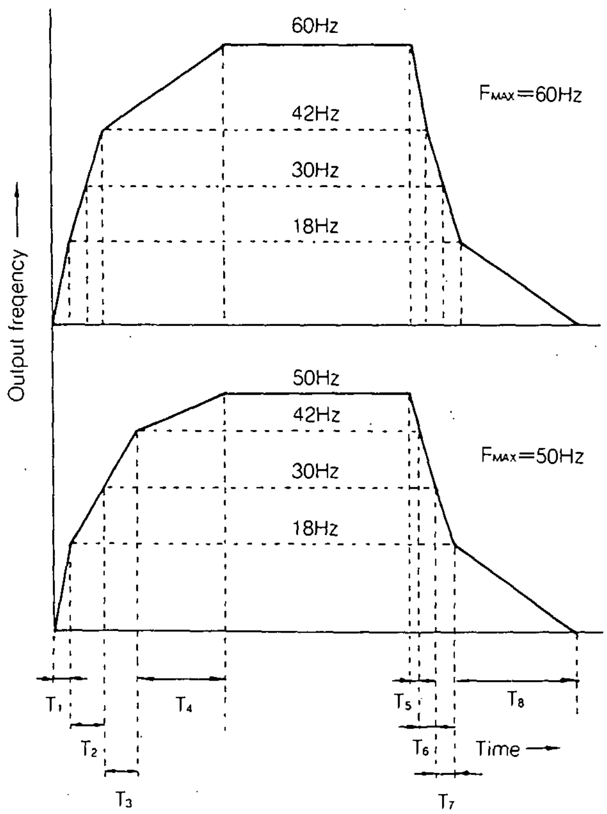
$$T_2 = T_{ACC} \times \frac{33}{109 + \alpha} \qquad T_6 = T_{DEC} \times \frac{33}{335 + \beta}$$

$$T_3 = T_{ACC} \times \frac{47}{109 + \alpha} \qquad T_7 = T_{DEC} \times \frac{47}{335 + \beta}$$

$$T_4 = T_{ACC} \times \frac{\alpha}{109 + \alpha} \qquad T_8 = T_{DEC} \times \frac{255}{335 + \beta}$$

Where

$$\alpha = 255 \times \frac{F_{MAX} - 42}{18} \qquad \beta = 29 \times \frac{F_{MAX} - 42}{18}$$



■ Motor noise reduction

Function Code No. 31

Noise is reduced by changing the modulation degree of the sawtootn carrier frequency modulation control system.

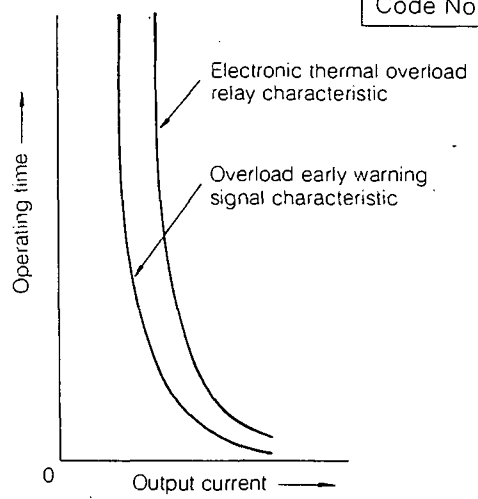
FUNCTION	DATA	
31	C - - 1	1, 2, 3, 4

■ Overload early warning signal

Function Code No. 32

Early warning signals are given if the inverter output current exceeds the overload alarm level for a certain period of time. This is an open-collector output. If the optional relay unit is used, this signal can be used as a contact output.
If 0 is set, this function is inactive.

FUNCTION	DATA	
32	105	0, 50 to 105%



■ Torque Limiter(driving and braking)

Function Code No. 33 34

Torque limiting operation is based on calculations derived from the output voltage and current detection. This function enables automatic acceleration and deceleration, excellent recovery characteristics during impact load at constant speed running, and smooth inverter recovery after an instantaneous power failure.

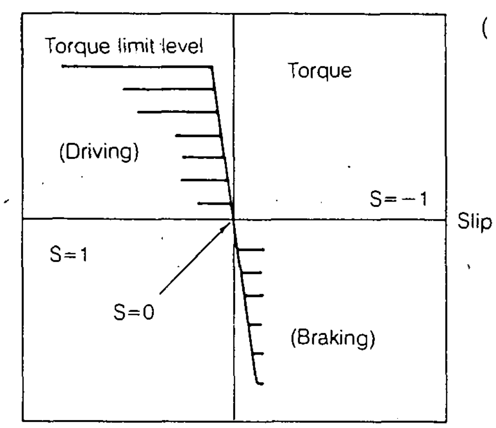
FUNCTION	DATA	
33	150	–, 20 to 180% (120) Driving
34	100	0, 20 to 180% (150) Braking

( ):P7 series

Automatic acceleration and deceleration control
Even if acceleration and deceleration times shorter than those required by the load inertia, G7/P7 inverters will automatically extend proper acceleration and deceleration times, while maintaining the torque limiting level.

Torque limiting level setting range
Driving: – and 20 to 180%(150% for P7 series)
Braking: 0 and 20 to 180%(150% for P7 series)
Note: If "–" is set during driving mode, this function is not active.

Automatic deceleration control
Even if a braking resistor is not used, the function provides faster deceleration and stopping than the normal set time without overvoltage trip.



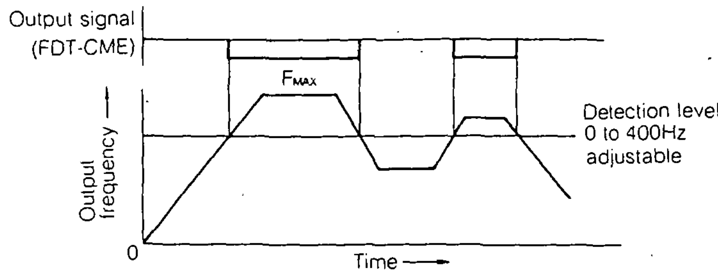
Note: The data setting for function code 34 is 100%, assuming that a braking resistor is connected. If no braking resistor is connected, setting should be changed to 0 or 20%. If left at 100%, an overvoltage trip will occur during deceleration.

Frequency level detection (FDT)

Function Code No. 35

This signal is active (on) when the output frequency exceeds the detection level. This is an open-collector output. If the optional relay unit is used, this signal can de used as a contact output.
Refer to terminal specification (Page 57).

FUNCTION	DATA	
3 5	3 0	FDT 1 to 400Hz

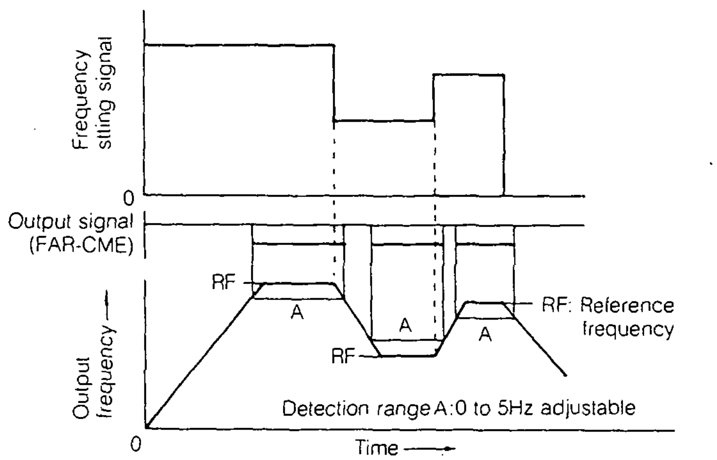


Frequency equivalence detection range (FAR)

Function Code No. 36

This signal is active (on) when the output frequency reaches the reference frequency.
This is an open-collector output. If the optional relay unit is used, this signal can be used as a contact output.
Refer to terminal specification (Page 57).

FUNCTION	DATA	
3 6	2.5	FAR 0.5 to 5.0Hz

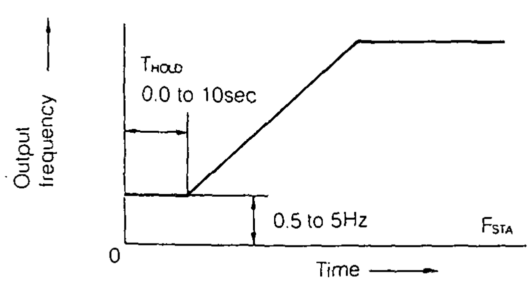


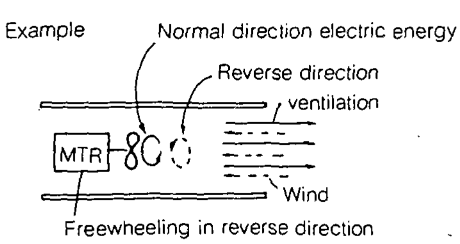
Starting frequency holding time

Function Code No. 37 38

The starting frequency F_{STA} suitable for the starting torque characteristics of the load and the start frequency's holding time T_{HOLD} can be set. The existence of starting frequency holding time permits a rotating start of a motor freewheeling in the reverse direction.
(These settings are invalid during deceleration or forward ⟷ reverse operation)

FUNCTION	DATA	
3 7	0.5	F_{STA} 0.5 to 5.0Hz
3 8	0.0	T_{HOLD} 0.0 to 10.0SEC



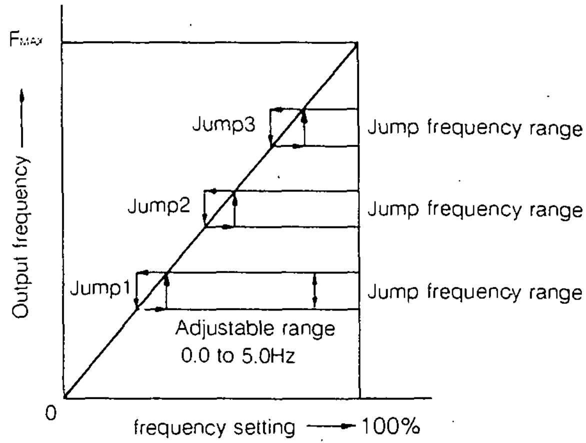


Jump frequency jump1 jump2 jump3
Jump frequency range

Function Code No.	39	3A	3b	3C

These functions are used to avoid continuous operation at mechanical resonance points.
Three jump frequencies can be set. Jump frequencies are not active during acceleration and deceleration or if the multistep frequency settings are used.
The jump frequency range is adjustable between 0.0 to 5.0Hz.

FUNCTION	DATA	
39	0.0	JUMP1 0.0, 0.5 to 400.0Hz
3A	0.0	JUMP2 0.0, 0.5 to 400.0Hz
3b	0.0	JUMP3 0.0, 0.5 to 400.0Hz
3C	2.0	0.0 to 5.0Hz



Number of motor poles
Machine speed conversion coefficient

Function Code No.	3d	3E

These parameter functions are set to monitor the synchronous speed of the motor and the machine speed.

FUNCTION	DATA	
3d	4	Poles 2, 4, 6, 8, 10, 12
3E	1.0	Machine speed conversion coeffcient 0.1 to 10.0

Machine speed = (Motor synchronous speed of motor) × (Machine speed conversion coefficient)

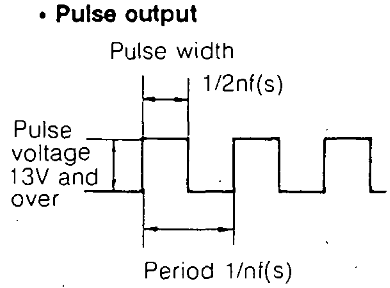
Frequency monitors

Function Code No.	40	50

The external output frequency meter can be calibrated.
Pulse output or analog output can be selected with the internal switch (SW2) of the inverter.

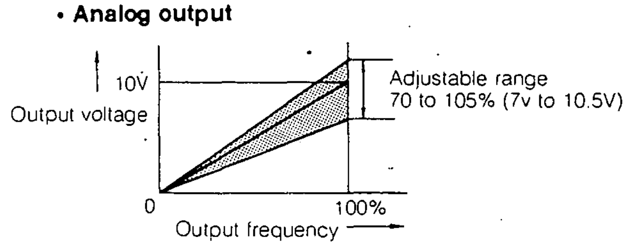
FUNCTION	DATA	
40	30	Digital frequency monitor coefficient 6 to 100
50	100.0	Analog frequency meter calibration 70.0 to 105.0%

- **Pulse output**

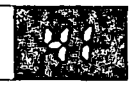


Number of output pulse = n×f
n : Setting coefficient 6 to 100
f : Output frequency

- **Analog output**



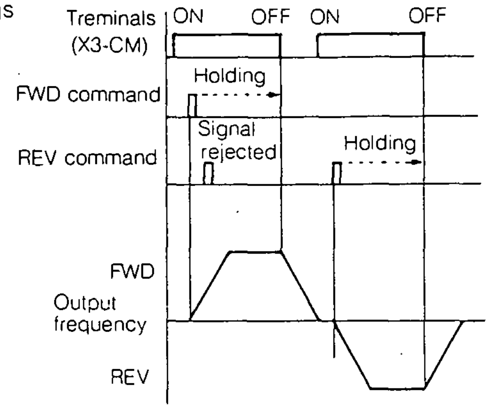
FWD/REV Command hold (3-wire control)

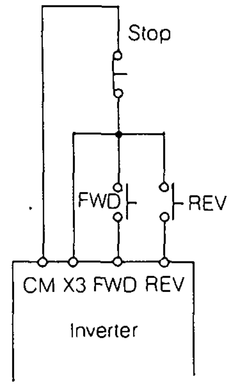
Function Code No.


This function enables control by a momentary (50ms minimum) RUN/STOP command (FWD and REV command). The self-hold circuit can be omitted to simplify the circuit. When the function is selected, multistep frequency settings from 1 to 3 can be used, but those from 4 to 7 cannot.

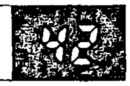
FUNCTION: 4 1 DATA: -

Active: o
Inactive: -





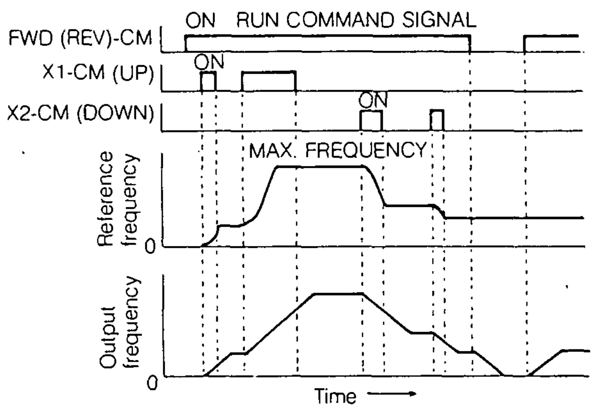
Up-down control

Function Code No.


The frequency setting can be increased and decreased using the X1-CM and X2-CM terminal groups. This function is similar in operation to that of a motor driven potentiometer. The setting is retained even if the power supply is turned off. When operation is restarted, the frequency automatically increases to the set value.

FUNCTION: 4 2 DATA: -

Active: o
Inactive: -



Note: 1) When this control function is selected, multistep, frequency setting 4 can de used. but the other 6 settings cannot.
2) Multistep frequency setting, FWD/REV command hold, and up-down control cannot be used simultaneously because the same terminals are used for these functions.
3) If up-down control is selected, operarion by the external voltage or current signal for frequency setting cannot be used.
4) If the Up and Down commands are input together, the Down command has priority.

Function Code					Teminal X1	Teminal X2	Teminal X3
23 to 25	26	27 to 29	41	42			
O	O	O	-	-	Multistep frequency setting		
-	O	-	-	O	UP-DOWN control		Multistep frequency setting 4
O	-	-	O	-	Multistep frequency setting 0 to 3		FWD/REV command hold
-	-	-	O	O	UP-DOWN control		FWD/REV command hold

O: Active -: Inactive

Restart after instantaneous power failure

Function Code No. 43

This function specifies whether the inverter is to be restarted automatically when power is restored after an instantaneous power failure. If automatic restart is selected, the inverter is restarted after power recovery under the following conditions:

1) The power failure duration is within the allowable time. (3-wire control)
2) The RUN command is input.

FUNCTION: 4 3 DATA: o

Active: o
Inactive: –

Undervoltage alarm

Function Code No. 44

If the DC intermediate circuit voltage drops to the under-voltage level, the inverter output is turned off. This function specifies whether an alarm signal is to be transmitted when this voltage drop occurs.
Selecting this function locks the inverter in a fault monitoring mode when an undervoltage occurs. The restart function(43) has priority over this function.

FUNCTION: 4 4 DATA: o

Active: o
Inactive: –

Setting	Inverter	Self-hold	Alarm display	Alarm signal
o	Stopped	on	on	on
–	Stopped	off	on	off

Output signal code selection (Open-collector)

Function Code No. 45

The RUN, FAR, FDT, OL,and LV terminals are used to output faults and operation monitoring signals. The output mode can be selected with this function. Three modes, 0, 1, and 2, can be selected. If mode 1 or 2 is selected, signals are output in a bit pattern.

FUNCTION: 4 5 DATA: 0

0, 1, 2

Table(a) Output signal selection

<table>
<tr><th rowspan="2">Terminals</th><th colspan="3">Setting</th></tr>
<tr><th>0</th><th>1</th><th>2</th></tr>
<tr><td>RUN</td><td>Inverter running</td><td rowspan="3">Individual fault output</td><td rowspan="5">Combinations of operation monitor and individual fault signals</td></tr>
<tr><td>FAR</td><td>Frequency equivalence detection</td></tr>
<tr><td>FDT</td><td>Frequency level detection</td></tr>
<tr><td>OL</td><td>Overload early warning</td><td>Overload early warning</td></tr>
<tr><td>LV</td><td>Undervoltage alarm</td><td>Undervoltage alarm</td></tr>
</table>

Individual fault output when "1" is set at Table (a).

Individual fault / Terminal symbol	OC Overcurrent	OU Overvoltage	LU Undervoltage	OL1 Inverter overload	OL2 Motor overload	OH1 Inverter overheat	OH2 External alarm	No fault
RUN	○	○	○	●	●	●	●	○
FAR	○	●	●	○	○	●	●	○
FDT	●	○	●	○	●	○	●	○

Note: ●: ON; ○: OFF

Operation monitor output when"2" is set at Table (a) (while inverter is running)

Operation monitor				Terminal symbol				
Operating	Frequency equivalence detection (FAR)	Frequency level detection (FDT)	Overload early warning	LV	OL	FDT	FAR	RUN
□	□	□	□	○	○	○	○	○
■	□	□	□	○	●	○	●	○
■	□	■	□	●	●	○	●	○
■	■	□	□	○	○	●	●	○
■	■	■	□	●	○	●	●	○
■	□	□	■	○	●	●	●	○
■	□	■	■	●	●	●	●	○
■	■	□	■	○	○	○	○	●
■	■	■	■	●	○	○	○	●

Note: ■: monitor signal available; □: no monitor signal; ●: ON; ○: OFF

Individual fault output when "2" is set at Table (a). (when inverter is tripped)

Individual fault	Terminal symbol				
	LV	OL	FDT	FAR	RUN
No falt	○	○	○	○	○
OC1 Acceleration overcurrent	●	○	○	○	○
OC2 Deceleration overcurrent	○	●	○	○	○
OC3 Constant-speed overcurrent	●	●	○	○	○
OU Overvoltage	○	○	●	○	○
LU Undervoltage	●	○	●	○	○
OL1 Inverter overload	○	●	●	○	○
OL2 Motor overload	●	●	●	○	○
OH1 Inverter overheat	○	○	○	●	○
OH2 External alarm	●	○	○	●	○

Note: ■: ON; ■: OFF

Slip compensation control

This function compensates for variations in speed caused by load fluctuations. The amount of slip frequency compensation is from 0.0 to 2.5Hz for the reted slip.

Function Code No. 46

FUNCTION	DATA	
4 6	0.0	Slip frequency 0.0 to 2.5Hz

Reversing operation with signal polarity

This function enables the direction of motor rotation to be changed according to the polarity (+, −) of the frequency setting voltage.

To operate the inverter with an external frequency setting potentiometer, turn on the switch between terminals FWD and CM. Apply a positive voltage (+10V DC) to terminal V1 to turn the motor in the forward direction, or apply negative voltage to the terminal to turn it in the reverse direction.

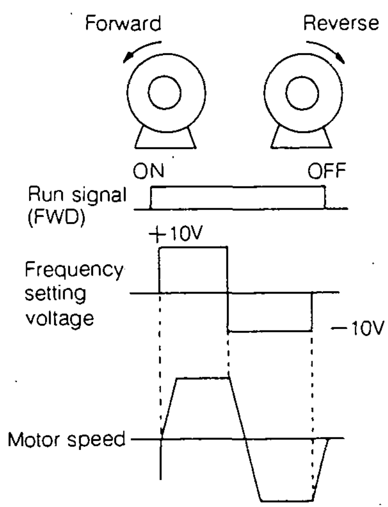
It the switch between terminals REV and CM is on, a positive voltage applied to terminal V1 turns the motor in the reverse direction and a negative voltage to the terminal turns it in the forward direction.

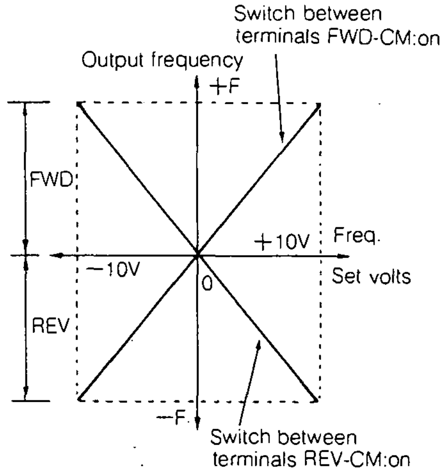
This means that the motor rotation direction can be changed only by changing the polarity of the setting voltage.

Note: When the multistep frequency setting function is used, Function code 47 is invalid.

Function Code No. 47

FUNCTION	DATA	
4 7	-	Active: o Inactive: -





AUXILIARY PARAMETER SETTING (Appendix)

Analog ammeter calibration (option)

Function Code No. 51

When an analog I/O card (OPC Ⅱ-AIO) is used, an analog ammeter can be connected and output current measured.
Function code 51 is used for ammeter calibration (10VDC).
Adjustment can be made from 50.0% to 200.0%.
OPC Ⅱ-AIO is mounted inside the inverter.

FUNCTION	DATA	
51	100.0	Analog ammeter calibration 50-200%

Correction of motor primary resistance

Function Code No. 52

- Function code 52 data need not to be changed when FUJI's standard motors are used.
- The use of low-frequency operation of motors made by other manufactures requires that the function code 52 data be modified. The acceptable error range for torque calculation will be shortened and trip-free control enabled. Calculate the setting value as it follows:

$$\text{Setting value} = \frac{\text{Primary coil resistance of motor used}}{\text{Primary coil resistance of FUJI's standard 3-phase motor. (See the table)}} \times 100(\%)$$

Adjustment range: 50 to 200%

FUNCTION	DATA	
52	100.0	Correction of motor primary resistance

The table on the right shows primary resistances for FUJI's standard motors. FRENIC5000G7/P7 is designed based on these data.

Primary resistance for FUJI's standard motor

Motor capacity (kW)	200V series		400V series	
	Type *	R1(Ω)	Type *	R1(Ω)
30	30P7 / 30G7	0.0285	30P7 / 30G7	0.1141
37	37P7 / 37G7	0.0245	37P7 / 37G7	0.0979
45	45P7 / 45G7	0.0187	45P7 / 45G7	0.0748
55	55P7 / 55G7	0.0145	55P7 / 55G7	0.0579
75	75P7 / 75G7	0.0098	75P7 / 75G7	0.0391
90	90P7 / 90G7	0.0078	90P7 / 90G7	0.0311
110	110P7	0.0060	110P7 / 110G7	0.0241
132			132P7 / 132G7	0.0191
160			160P7 / 160G7	0.0150
200			200P7 / 200G7	0.0113
220			220P7 / 220G7	0.0100
280			280P7	0.0074

* Abbreviation

Manufacturer use function

Function Code No. 99

Function code: 99
Function code 99 is used for manufactures of machines in which FUJI's inverters are used. This code is not used for ordinary users.

FAILURE MESSAGE

Fault display

Function Code No. F0 TO F7

The fault display function performs three functions.
1) Displays present faults
2) Displays the operation status when the fault occurs.
3) Displays a record of immediately previous 3 faults.
If a fault occurs, the fault monitoring mode is set automatically.

F0 Faults display *
F1 Output frequency *
F2 Reference frequency *
F3 Output current *
F4 Operation mode *
F5 Fault memory 1
F6 Fault memory 2
F7 Fault memory 3
* mark: when the first fault occured

Function	Data				Message
F0	1. to 7.	0	C	1	Overcurrent during acceleration
		0	C	2	Overcurrent during deceleration
		0	C	3	Overcurrent during constant speed running
			0	U	Overvoltage
			L	U	Undervoltage
		0.	H	1	Inverter overheating
		0	H	2	External fault
		0	L	1	Inverter overload
		0	L	2	Motor overload
—	E	r	r	0	CPU error
	E	r	r	d	Memory errpr
F1		6	0.	0	Output frequency
F2		6	0.	0	Reference frequency
F3	1	0	0.	0	Output current
F4	1. to 4.		F	0	Forward rotation
			r	E	Reverse rotation
			C	L	Current limit
			U	L	Voltage limit
			U	U	Undervoltage limit
F5					1st order fault (1st prior event)
F6					1st order fault (2nd prior event)
F7					1st order fault (3rd prior event)

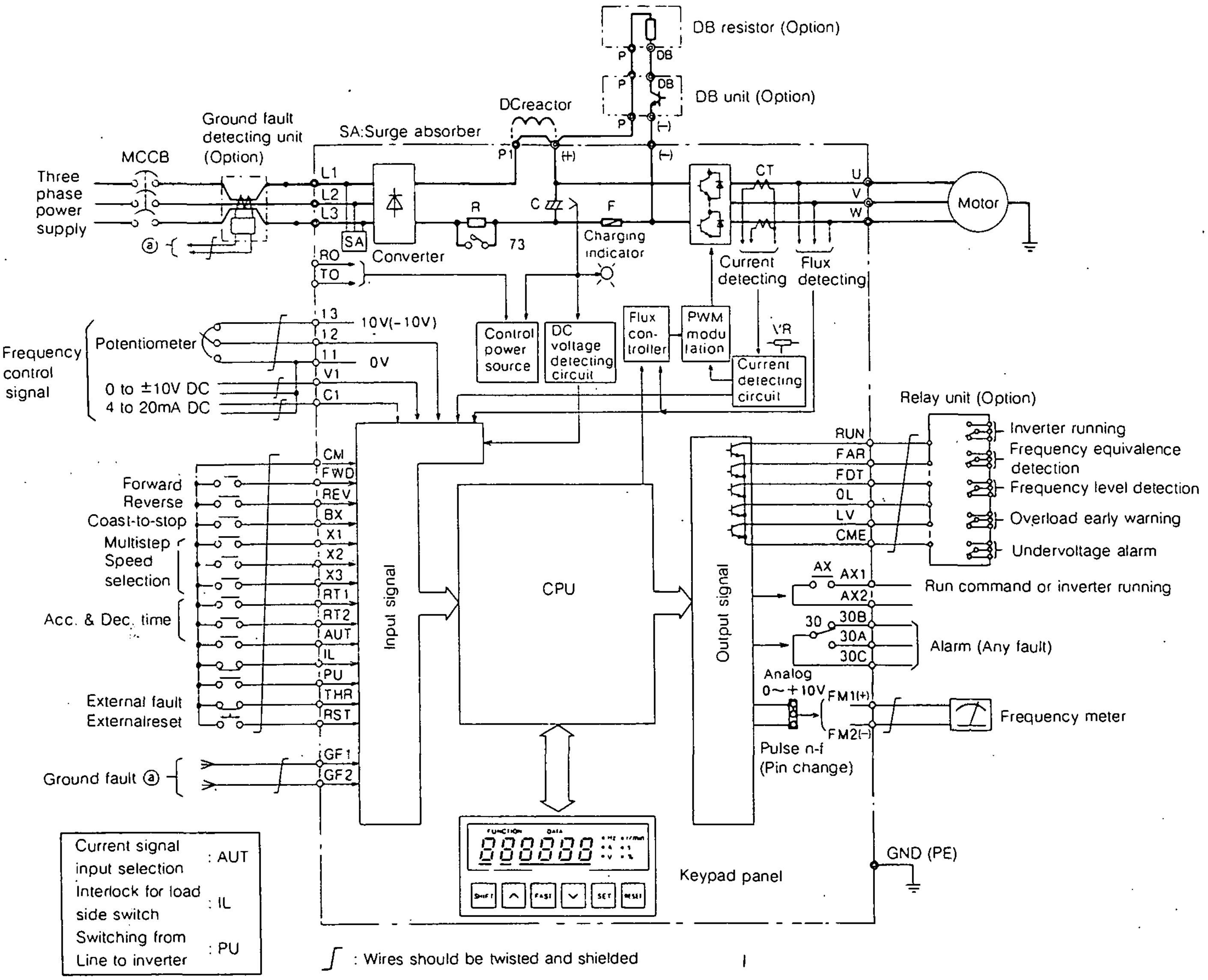
Notes: 1) Function code F0 is not displayed at cpu error or memory error.
2) Data of F1 to F3 shown here is examples.

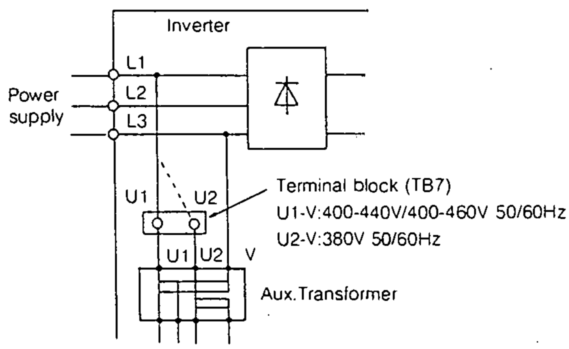
Protection functions

Display	Function	Description
–	Stall prevention	The accceleration time is automatically extended to avoid an overcurrent trip due to quick acceleration. The deceleration time is also automatically extended to avoid an overcurrent or an overvoltage trip due to quick deceleration.
CL	Current limiting	Inverter output current is automatically limited if it reaches the limit level.
–	Instantaneous power failure	When the power failure occurs, the motor is driven fifteen milliseconds at full load. (Running time will be longer on light load).
LU	Undervoltage protection	• When the DC intermediate circuit voltage drops to the undervoltage level, the inverter immediately shuts down and holds the trip status. • If power failure continues and the control voltage in the inverter is lost, and the inverter will de reset automatically.
OC1 OC2 OC3	Overcurrent protection (Short-circuit and Ground fault)	If the inverter output current reaches the overcurrent protection level, the inverter immediately shuts down. and holds the trip status. The overcurrent trip indication is divided into 3 types. OC1 : Overcurrent detection during acceleration OC2 : Overcurrent detection during deceleration OC3 : Overcurrent detection during running at constant-speed The inverter can de protected from ground fault by adding an optional ground fault detection unit. Since the ground fault detection unit protects the inverter, an earth leakage circuit breaker (ELCB) must be used to prevent injury or accident.
OU	Overvoltage protection	If the DC intermediate circuit voltage reaches the overvoltage protection level, the inverter immediately shuts down.
–	Input surge protection	The inverter can be protected from 5kV standard impact wave voltage which will invade from the main circuit power.
OL1	Inverter overload protection	If the load exceeds the overload capacity (inverse-time characterisic) of the inverter, the inverter immediately shuts down.
OH1	Inverter overheating protection	If the heat sink of the inverter overheats or the temperature inside the inverter exceeds the limit, the inverter immediately shuts down.
OL2	Motor overload protection (Electronic thermal overload relay)	When only one motor is driven, the motor can be protected from an overload without an external thermal overload relay. Since the electronic thermal overload relay is designed with consideration also given to the low cooling effect in the low-speed range, this protection works over a wide range. When driving several motors, attach a thermal overload relay to each motor for protection.
OH2	External fault protection	If the thermostat of the braking unit or braking resistor (options) or the external thermal overload relay for motor protection is active, the inverter immediately shuts down. If FWD-CM or REV-CM is on state when applying the power, the inverter will not run and indicate "OH2".
Err0	CPU error protection	If a CPU error occurs inside the inverter, the inverter shuts down.
Errd	Memory error protection	If a memory error occurs inside the inverter, the inverter shuts down.

11-4 Terminals

(1) Composition of main circuit and terminals





(2) Terminal Function

① Main circuit

Symbol	Terminal	Description
L1, L2 ,L3	Main circuit (Input)	Connect a three-phase power supply.
U, V, W	Inverter output	Connect a three-phase motor
(+), (−)	Braking unit connection	Connect the braking unit (option). The braking resistor must be connected via the breaking unit.
(+), P1	DC reactor connection	Connect a DC reactor for power-factor correcting (option). (See page 30)
GND (PE)	Ground terminal	Ground terminal for the inverter chassis (housing) (Be sure to ground the chassis to prevent electrical shock and to reduce radio interference noise.)

② Control circuit

Type	Symbol	Terminal	Description
Control power supply	R0, T0	Auxiliary control power supply	Connect a single-phase AC power supply to back up the control circuit power supply
Frequency setting and monitoring	11	Frequency control common	Frequency setting signal terminal (common reference voltage for terminals 12, 13, V1, and C1)
	13	Frequency control power supply	Use this terminal for the frequency setting POT: +10V DC, 1kΩ. −10V DC can also be output by changing the internal pin connection. (The output is set to +10V DC at the factory.)
	12	Frequency control input terminal	0V to ±10V DC, input resistance: 22kΩ Maximum output frequency at ±10V DC The frequency based on the sum of setting signals 12 and V1 is output. When the input voltage is 0V to ±5V DC, select and set Function code 18.
	V1	Voltage process signal	0V to ±10V DC, input resistance: 22kΩ Minimum output frequency at ±10V DC
	C1	Current process signal	4mA to 20mA DC, input resistance: 250Ω Minimum output frequency at 4mA and maximum output frequency at 20mA C1: +, 11: −
	FM1, FM2	Frequency meter connection	0 V to 10 V DC (maximum frequency at 10V) Two voltmeters each having an internal resistance of 10kΩ, can be connected. Pulse signals can be output by changing the internal setting pins (SW2). FM1: +, FM2: −
Contact input	CM	Contact input common	Common terminal for contact input signals
	AUT	Current input selection	Specify an input signal when both voltage and current signals are available for frequency setting. AUT-CM ON: current input, OFF: voltage and frequency setting POT inputs
	FWD	Forward operation or stop command	FWD-CM ON: forward, OFF: stop The motor stops when both FWD and REV are on or off together.
	REV	Reverse operation or stop command	REV-CM ON: reverse, OFF: stop
	X1, X2, X3	Multistep frequency selection	Up to 8 frequencies can be set by turning on and off the external contact signals.
	X1, X2	Up-down control	Function of terminals X1 and X2 changes by making Function code 42 active. X1-CM ON: UP (frequency increase), X2-CM ON: DOWN (frequency decrease)
	X3	FWD/REV command hold	Function of terminal X3 changes by making Function code 41 active. X3-CM ON: Self-holds FWD or REV momentary signals input (pulse width: 50 ms or more)
	RT1, RT2	Acc./dec. time selection 2, 3, or 4	The 4 acceleration or deceleration times can be selected by turning on and off the external contact signals.
	BX	Coast-to-stop command	BX-CM ON: Instantaneous stop of inverter output with no alarm signals. Since the self-hold function does not work, turning off BX will restore the inverter if FWD or REV are still on.
	PU	Switching operation from line to inverter	The inverter is ready when the terminals PU and CM are shorted. Turning off the switch after the specified time changes over from line to inverter operation.
	IL	Interlock for load side switch	If a switch is installed between the inverter and the motor, the auxiliary contact (NC contact) is connected.
	THR	External fault input	If the connection between terminals THR and CM is opened, the inverter output is turned off and a motor coast-to-stop results. (OH2 trip) This input signal is self-held internally.
	RST	Alarm reset	If the terminals RST and CM are shorted while the inverter is tripped, the protection function is cancelled.

Control circuit (Cont'd)

Type	Symbol	Terminal	Description	
Open-collector output	CME	Open-collector output common	This is the common terminal for open-collector outputs.	Open-collector output 50mA max. 27V max. These terminals can also output individual faults. For details, refer to page 49 and 50.
	RUN	Inverter running	An on signal is output between RUN and CME at and above the starting frequency. This signal is turned off when the inverter is not operating, the motor coasts-to-stop or during DC braking.	
	FAR	Frequency equivalence detection	When the output frequency is in the range of the reference frequency ±△fHz, an on signal is output between FAR and CME. (△f: 0.5 to 5Hz variable)	
	FDT	Frequency level detection	An on signal is output between FDT and CME when the output frequency is higher than the preset detection level. The signal is turned off when the output frequency is below the detection level.	
	OL	Overload early warning	An on signal is output between OL and CME when the output current is larger than the preset overload alarm level. The signal is turned off when it is smaller. (Adjustment range: 50% to 105%)	
	LV	Undervoltage	An on signal is output between LV and CME when the inverter output is turned off due to undervoltage. This signal is not output for about 1.5sec. after power-up in order for power supplies to stabilize.	
Contact output	AX1, AX2	Run command or inverter running	This signal is used to open or close the contactor on the power supply side. Aux. power supply (R0-T0) required.	Contact capacity: 250V AC, 0.3A (cos ϕ =0.3)
	30A, 30B, 30C	Alarm output (Any fault)	An signal is output when the protection functions of the inverter are active and when the inverter tripps. (Contact: 1SPDT, 30A-30C: on the inverter trips)	
Protection	GF1,GF2	Ground fault detection input	This is the input terminal for the ground fault detection unit (option) to protect the inverter.	

(3) Terminal arrangement and size of terminal screw

① Terminal arrangement figures

Figure A

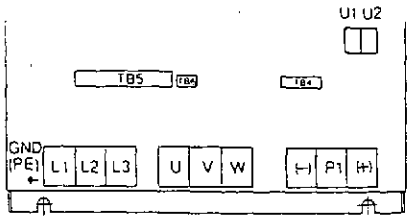


Figure B

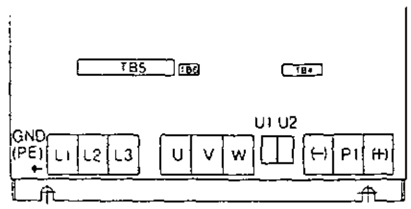


Figure C

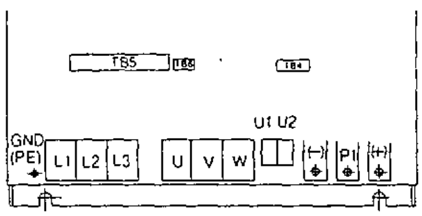
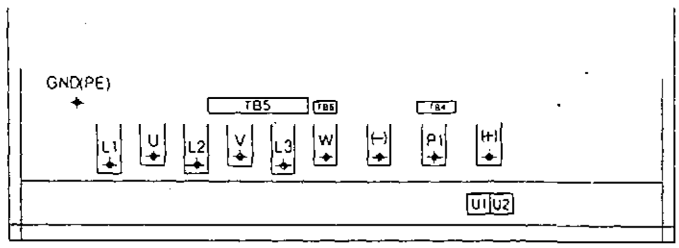
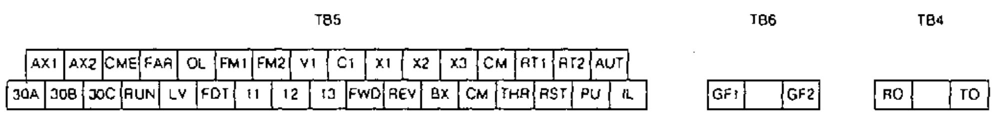


Figure D



② Arrangement figure of control circuit terminals



③ Table of terminal arrangements and terminal screw sizes

Voltage	Applicable motor output [kW]	Inverter type	Figure	Screw size							
				Main circuit terminals					Control circuit terminals		
				L1, L2, L3	U, V, W	(+), P1, (−)	GND (PE)	U1, U2	TB4	TB5	TB6
200V Series	30	FRN030G7/P7-2EX	A	M8	M8	M8	M6		M4	M3	M3
	37	FRN037G7/P7-2EX					M8				
	45	FRN045G7/P7-2EX	A	M10	M10	M10					
	55	FRN055G7/P7-2EX									
	75	FRN075G7/P7-2EX	C			ϕ11					
	90	FRN090G7/P7-2EX	D	ϕ13	ϕ13	ϕ13	M10				
	110	FRN110P7-2EX									
400V Series	30	FRN030G7/P7-4EX	A	M6	M6	M6	M6	M3			
	37	FRN037P7-4EX	A	M8	M8	M8					
		FRN037G7-4EX	A				M8				
	45	FRN045G7/P7-4EX									
	55	FRN055G7/P7-4EX									
	75	FRN075P7-4EX	A								
		FRN075G7-4EX	B	M10	M10	M10					
	90	FRN090G7/P7-4EX									
	110	FRN110G7/P7-4EX									
	132	FRN132G7/P7-4EX	C			ϕ11					
	160	FRN160G7/P7-4EX	D	ϕ13	ϕ13	ϕ13	M10	M3.5			
	200	FRN200P7-4EX									
		FRN200G7-4EX	D								
	220	FRN220G7/P7-4EX									
	280	FRN280P7-4EX									

12. Options

(1) Reactors

① Line side AC reactors

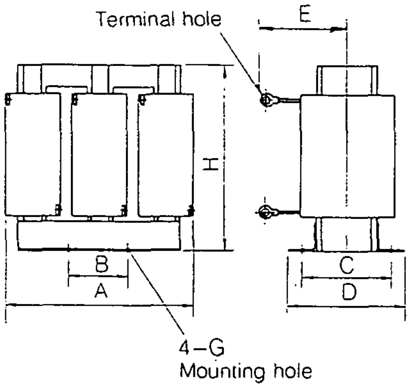


Fig. A

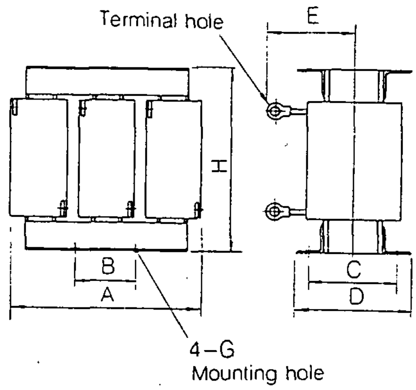


Fig. B

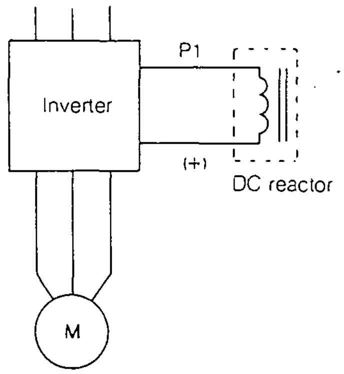
Voltage	Applicable motor output [kW]	Reactor type	Figure	Dimensions [mm]								Power loss [W]	Weight [kg]
				A	B	C	D	E	G	H	Terminal hole diameter		
200V Series	30	ACR2-37	A	190	60	90	120	170	7×11	190	8.4	60	11
	37												
	45	ACR2-55	B	190	60	90	120	200	7×10	190	13	82	12
	55												
	75	ACR2-75	B	250	100	90	120	200	9×14	250	13	114	25
	90	ACR2-90	B	285	190	120	158	190	12×20	210	13	120	26
	110	ACR2-110	B	280	150	110	138	200	10×20	270	13	135	30
400V Series	30	ACR4-37	A	190	60	90	120	170	7×10	190	8.4	82	11
	37												
	45	ACR4-55	B	190	60	90	120	200	7×10	190	10.5	88	12
	55												
	75	ACR4-75	B	190	60	90	126	197	7×10	190	11	89	12
	90	ACR4-110	B	250	100	105	136	202	9.5×18	245	13	98	24
	110												
	132	ACR4-132	B	250	100	115	146	210	9.5×18	250	13	162	32
	160	ACR4-220	B	320	120	110	150	240	12×20	300	13	223	40
	200												
	220												
	280	ACR4-280	B	380	130	110	150	260	12×20	300	13	295	52

② Power factor correcting DC reactors

The power factor can be improved to approx. 0.9 by using this reactor.

Note: The following inverters are provided as standard with separately supplied a power factor correcting DC reactor.
- ① Inverter of 75kW and above (G7 series 200 400V class)
- ② Inverter of 75kW and above (P7 series 200V class)
- ③ Inverter of 90kW and above (P7 series 400V class)

When installing inverters, be sure to connect this reactor.



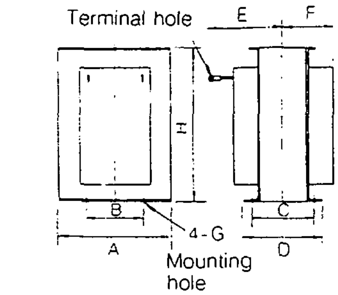


Fig. A

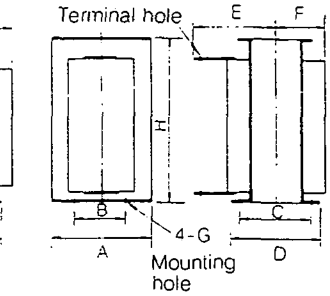


Fig. B

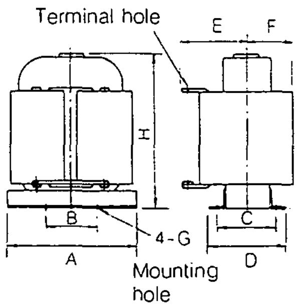


Fig. C

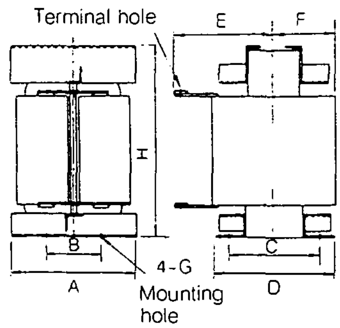
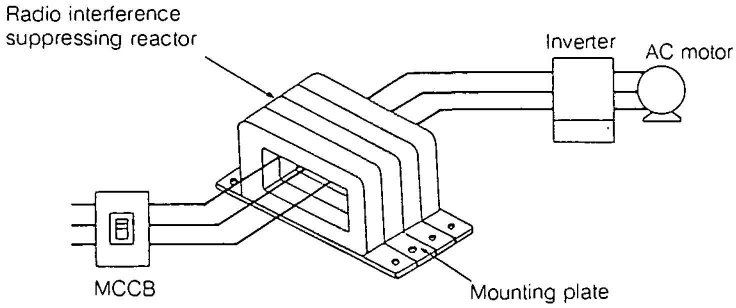


Fig. D

Voltage	Applicable motor output [kW]	Reactor type	Figure	Dimensions [mm]									Power loss [W]	Weight [kg]
				D	B	C	D	E	F	G	H	Terminal hole diameter		
200V Series	30	DCR2-30	A	146	75	100	126	130	70	9×15	210	10.5	61	16
	37	DCR2-37	B	156	80	100	126	110	70	9×15	260	10	72	19
	45	DCR2-45	B	156	80	110	136	130	75	9×15	260	10	82	23
	55	DCR2-55	B	170	85	110	136	130	75	9×15	300	10	98	28
	75	DCR2-75	C	200	80	95	126	180	75	10×16	240	12	100	19
	90	DCR2-90	D	180	100	100	131	150	75	10×15	275	15	140	22
	110	DCR2-110	D	200	100	120	141	150	80	10×15	290	15	210	25
400V Series	30	DCR4-30	A	150	75	85	111	155	70	9×15	210	8.4	63	14
	37	DCR4-37	A	146	75	100	126	155	70	9×15	210	8.4	56	17
	45	DCR4-45	A	146	75	115	141	180	75	9×15	210	10.5	58	21
	55	DCR4-55	A	146	75	130	156	190	85	9×15	210	10.5	66	25
	75	DCR4-75	D	200	70	120	151	160	80	10×16	250	10.5	95	25
	90	DCR4-90	D	220	70	140	171	165	85	10×16	280	13	94	32
	110	DCR4-110	D	220	70	150	181	170	95	10×16	290	13	115	36
	132	DCR4-132	D	190	80	146	177	180	90	11	360	13	100	40
	160	DCR4-160	D	220	90	140	171	200	90	12×20	350	12	115	45
	200	DCR4-200	D	230	100	140	181	180	110	12×20	310	15	140	50
	220	DCR4-220	D	230	100	150	201	180	110	12×20	320	15	160	50
	280	DCR4-280	D	230	100	160	211	180	110	12×20	340	15	170	58

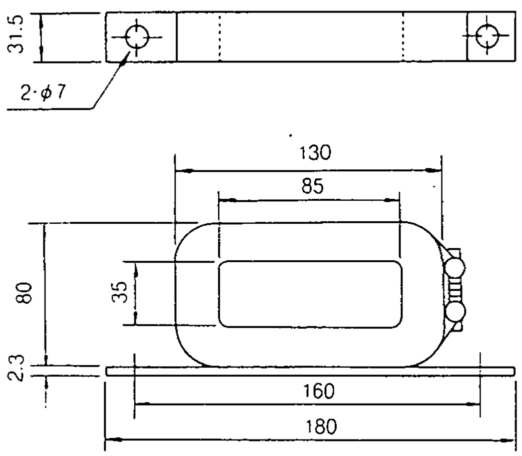
③ Radio frequency interference (RFI) suppressing reactor
Type: ACL-10A
These reactors are used to suppress radio interference.
Note that the method of connection differs depending on inverter capacity as shown in the figures on the right.



Dimensions	How to use

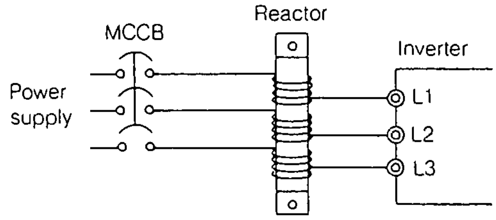
Dimensions

Type:ACL-10A unit[mm]

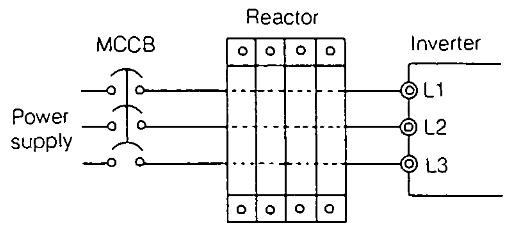


Weight:1.7kg

How to use



Wind the wire of each phase more than four turns in the same direction.



If the wire is too thick to wind, stack four reactors and run the wires through them.

④ Noise suppressing AC reactor

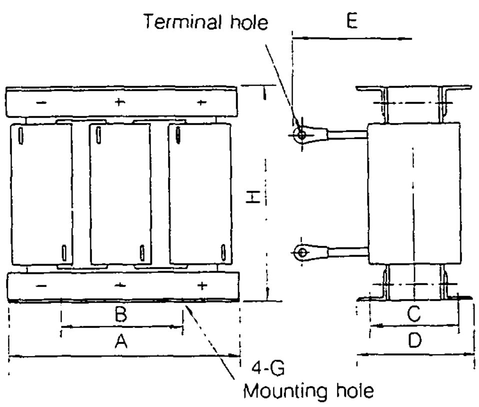


Fig. A

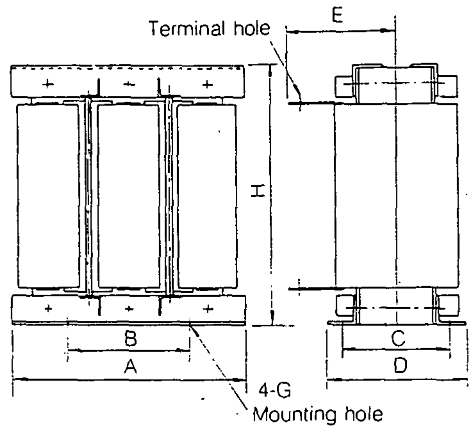
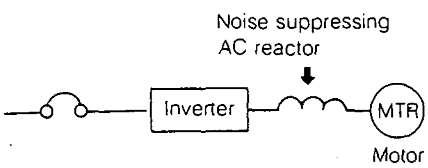


Fig. B

Voltage	Applicable motor output [kW]	Reactor type	Figure	Dimensions [mm]								Power loss [W]	Weight [kg]
				A	B	C	D	E	G	H	Terminal hole diameter		
200V Series	30	NR2-55	A	320	120	110	150	230	12×20	300	10.5	182	55
	37												
	45												
	55												
	75	NR2-75	A	300	150	115	156	200	12×20	310	13	215	53
	90	NR2-90	A	360	180	140	188	220	12×20	350	10.5	270	85
	110	NR2-110	A	390	200	150	198	200	12×24	360	13	350	95
400V Series	30	NR4-30	A	240	160	120	156	150	12×20	280	8.4	129	32
	37	NR4-37	A	250	160	120	156	150	12×20	290	8.4	142	38
	45	NR4-45	A	270	180	120	156	160	12×20	300	8.4	163	42
	55	NR4-55	A	300	180	130	156	182	12×20	300	8.4	178	53
	75	NR4-75	A	350	180	130	178	190	12×20	340	10.5	220	68
	90	NR4-90	A	360	180	140	188	200	12×20	350	10.5	240	80
	110	NR4-110	A	380	200	150	198	200	12×20	360	13	270	95
	132	NR4-132	B	380	200	180	233	180	15×24	430	15	370	120
	160	NR4-160	B	400	200	200	256	170	15×24	460	15	360	150
	200	NR4-200	B	400	200	210	273	190	15×24	500	15	470	180
	220	NR4-220	B	350	200	225	288	200	15×24	550	15	500	200
	280	NR4-280	B	450	300	200	268	275	15×20	470	13	700	165



Caution: When you connect the noise suppressing reactor, a derating (approx. 15 to 20%) of motor output will result due to voltage drop, since the impedance of these reactors is large.

(2) Braking unit (transistor switch) and resistors

Please refer to page 12 for connection

Item			Specification						
200V Series	Applicable motor output [kW]		30	37	45	55	75	90	110
	Inverter type		FRN030 G7/P7-2EX	FRN037 G7/P7-2EX	FRN045 G7/P7-2EX	FRN055 G7/P7-2EX	FRN075 G7/P7-2EX	FRN090 G7/P7-2EX	FRN110 P7-2EX
	Braking unit	Type	BU030-2AEX	BU055-2AEX			BU075-2AEX	BU055-2AEX	
		Required quantity	1	1			1	2	
	Braking resistor	Type	DBH030-2A	DBH037-2A	DBH045-2A	DBH055-2A	DBH037-2A	DBH045-2A	DBH055-2A
		Required quantity	1	1	1	1	2	2	2
		Capacity [kW] *1	3.6	4.8	6.0	7.2	9.6	12.0	14.4
		Resistance [Ω] *1	4.0	3.0	2.5	2.0	1.5	1.25	1.0

Item			Specification											
400V Series	Applicable motor output [kW]		30	37	45	55	75	90	110	132	160	200	220	280
	Inverter type		FRN030 G7/P7-4EX	FRN037 G7/P7-4EX	FRN045 G7/P7-4EX	FRN055 G7/P7-4EX	FRN075 G7/P7-4EX	FRN090 G7/P7-4EX	FRN110 G7/P7-4EX	FRN132 G7/P7-4EX	FRN160 G7/P7-4EX	FRN200 G7/P7-4EX	FRN220 G7/P7-4EX	FRN280 P7-4EX
	Braking unit	Type	BU037-4AEX		BU055-4AEX		BU110-4AEX			BU132 -4AEX	BU110-4AEX			BU132 -4AEX
		Required quantity	1		1		1			1	2			2
	Braking resistor	Type	DBH030 -4A	DBH037 -4A	DBH045 -4A	DBH055 -4A	DBH037 -4A	DBH045 -4A	DBH055 -4A	DBH045 -4A	DBH037 -4A	DBH045 -4A	DBH055 -4A	DBH045 -4A
		Required quantity	1	1	1	1	2	2	2	3	4	4	4	6
		Capacity [kW] *1	3.6	4.8	6.0	7.2	9.6	12.0	14.4	18.0	19.2	24.0	28.8	36.0
		Resistance [Ω] *1	15	12	10	7.5	6.0	5.0	3.75	3.33	3.0	2.5	1.88	1.67

Common specification

Braking torque [%]	100
Braking duty [%ED]	5 (allowable duration: 5sec.) *2
Protective function	If the braking unit or resistor overheats, braking unit transistors are shut down and the inverter protective function is active.
Ambient temperature	−10 to +50℃
Painted color	Braking mat: Munsell 5Y3/0.5 half-polish Braking resistor: Munsell N1,2 half-polish

*1 Total value, not for one resistor.   *2 Continuous durable time of braking unit: 60 sec.

① Braking unit

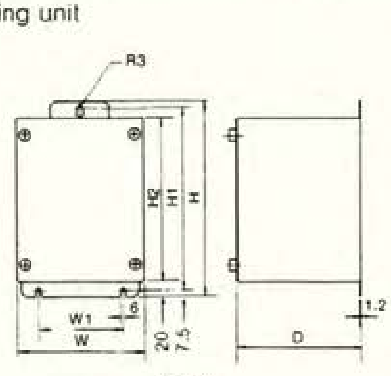


Fig. A

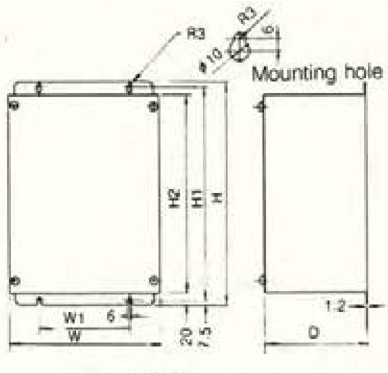


Fig. B

Terminal arrangement

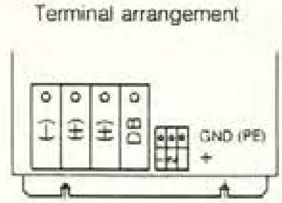


Fig. C

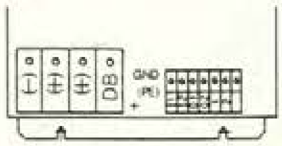


Fig. D

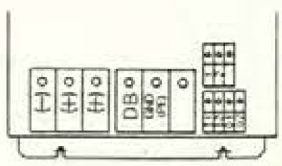
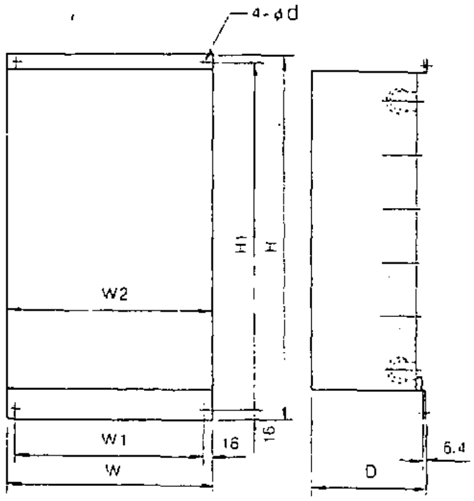


Fig. E

Voltage	Type	Figure	Dimensions [mm]						Terminal arrangement screw size			Weight [kg]
			W	W1	H	H1	H2	D	Figure	(+), (−), DB, GND (PE)	1, 2, (I1, I2, 01, 02)	
200V Series	BU030-2AEX	A	150	100	240	225	200	150	C	M5	M4	5
	BU055-2AEX	B	230	130	240	225	200	170	D	M6		7
	BU075-2AEX		250	150	370	355	330	170	C	M8		11
400V Series	BU037-4AEX	B	180	100	280	265	240	160	C	M5	M4	6
	BU055-4AEX		230	130	280	265	240	160				6
	BU110-4AEX		250	150	400	385	360	170	D	M6		12
	BU132-4AEX								E	M8		

2. Braking resistor



200V Series

Type	Dimensions (mm)						Terminal arrangement and screw size			Weight (kg)
	W	W1	W2	H	H1	D	Figure	P. DB	1, 2, E	
DBH030-2A						140		M5		11
DBH037-2A	400	380	400	660	628		8		M4	15
DBH045-2A						240		M6		20
DBH055-2A			405	750	718					25

400V Series

Type	Dimensions (mm)						Terminal arrangement and screw size			Weight (kg)
	W	W1	W2	H	H1	D	Figure	P. DB	1, 2, E	
DBH030-4A						140	A	M4		11
DBH037-4A	420	388	420	660	628				M4	15
DBH045-4A						240	8	M5		20
DBH055-4A			425	750	718					25

Fig. A

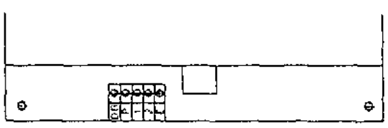
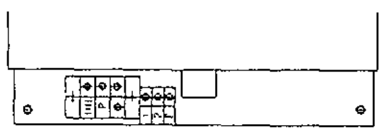


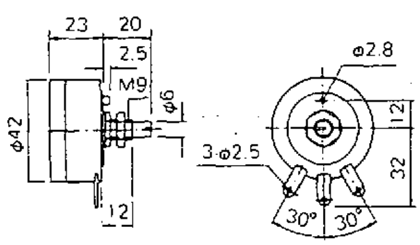
Fig. B



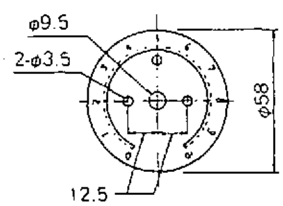
(3) Parts of control circuit

① Potentiometer for frequency control

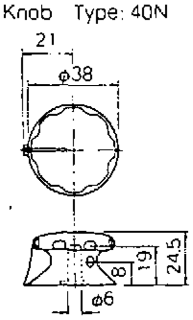
Type: WAR3W-1kΩ (3W)B-characteristics



Scale plate Type: 60P



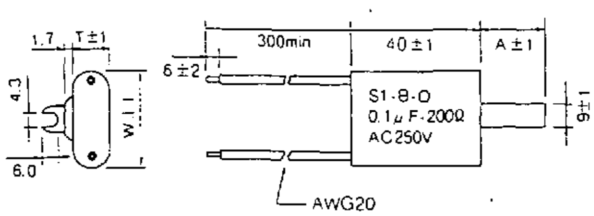
Knob Type: 40N



Note: Scale plate and knob are sold separately from POT itself.

② Surge absorber (Noise suppressor)

S1-B-0, S2-A-0



Type	Use with	Capacitance (F)	Resistance (Ω)	Dimensions, mm			
				W	H	T	A
S-1-B-0	Control relay or timer	0.1	200 (1/2W)	17.5	40	9.1	20.0
S-2-A-0	Magnetic contactor	0.2	500 (1/2W)	27.5	40	10.4	30.0

Circuit voltage: less than 250V (Products of Okatani electric Industries)

13. Distribution & Control equipment

Voltage	Applicable motor output [kW]	Inverter type	MCCB ( ): Interrupting capacity	ELCB ( ):Interrupting capacity	Magnetic contactor	Main circuit wire U, V, W L1, L2 L3 (mm^2)	DC intermediate circuit wire (mm^2)	
							P1, (+)	(+), (−
200V Series	30	FRN030G7/P7-2EX	SA203B/150 (50KA)	EGa203B/150 (18KA)	SC-6N	60	38×2	8
	37	FRN037G7/P7-2EX	SA203B/200 (50KA)	EGa203B/200 (18KA)	SC-7N	38×2	38×2	14
	45	FRN045G7/P7-2EX	SA203B/225 (50KA)	EGa203B/225 (18KA)	SC-8N	60×2	60×2	22
	55	FRN055G7/P7-2EX	SA403K/300 (42KA)	EGa403A/300 (35KA)	SC-10N	60×2	100×2	22
	75	FRN075G7/P7-2EX	SA403K/350 (42KA)	EGa403A/350 (35KA)	SC-12N	100×2	150×2	38
	90	FRN090G7/P7-2EX	SA403K/400 (42KA)	EGa403A/400 (35KA)		150×2	150×2	22×2
	110	FRN110P7-2EX	SA603H/500 (85KA)	EGa603A/500 (42KA)	SC-14N	200×2	200×2	22×2
400V Series	30	FRN030G7/P7-4EX	SA103B/75 (25KA)	EG103B/75 (5KA)	SC-3N	22	22	3.5
	37	FRN037G7/P7-4EX	SA103B/100 (25K)	EG103B/100 (5KA)	SC-4N	38	38	5.5
	45	FRN045G7/P7-4EX	SA203B/125 (25KA)	EGa203B/125 (10KA)	SC-5N	38	60	8
	55	FRN055G7/P7-4EX			SC-6N	60	38×2	14
	75	FRN075G7/P7-4EX	SA203B/200 (25KA)	EGa203B/200 (10KA)	SC-7N	38×2	38×2	14
	90	FRN090G7/P7-4EX	SA203B/225 (25KA)	EGa203B/225 (10KA)	SC-8N	60×2	60×2	22
	110	FRN110G7/P7-4EX	SA403K/250 (30KA)	EGa403A/250 (22KA)	SC-10N	60×2	100×2	22
	132	FRN132G7/P7-4EX	SA403K/300 (30KA)	EGa403A/300 (22KA)	SC-11N	100×2	150×2	38
	160	FRN160G7/P7-4EX	SA403K/400 (30KA)	EGa403A/400 (22KA)	SC-12N	100×2	150×2	22×2
	200	FRN200G7/P7-4EX	SA603H/500 (42KA)	SG603A/500 (42KA)		150×2	200×2	22×2
	220	FRN220G7/P7-4EX			SC-14N	200×2	200×2	22×2
	280	FRN280P7-4EX	SA603H/600 (42KA)	SG603A/600 (42KA)		200×2	200×2	38×2

Note: 1. The above data is based on Fuji Electric's general-purpose motors. (4-Pole)
2. When using an E series molded case circuit breaker or an SG series earth leakage circuit breaker, match the rated currents.
3. Wire sizes are based on 600V PVC.
Numerals in ( ) fall under WL1 electric wire, i.e.
Furukawa Denko-made 600V leading wire or FSLC, i.e. Furukawa Denko-made panel wiring electric wire.
4. Wire sizes for (+), (−) (Braking) circuit are based on that braking duty is 5%ED.

14. Inspection list

Inspection spot	Inspection item	Description	Inspection frequency or circle: Daily	Periodically: Annually	Periodically: Every two years	Inspection method	Criteria
General	Ambient situation	Confirmation of ambient temperature, humidity, dust, harmful gas, oil mist, etc.	○			Refer to "ItemNo. 4 Installation".	Table 4-1 of Item No. 4-1 shall be satisfied.
	Equipment in general	Any abnormal vibration and noise	○			Visually and auditorily	Nothing shall be found abnormal.
	Power voltage	Are main circuit and control voltages normal?	○			Measurement of voltages between phases L1, L2, L3 of main power input terminal	200V series: 200V/50Hz, 200~230V/60Hz 400V series: 400~420V/50Hz, 380~400/50Hz, 400~460/60Hz
Main circuit	General	(1) Megger check (between main circuit terminal and grounding terminal) (2) Is tightened part not lose? (3) Is each part not overheated? (4) Cleaning		(2) ○ (3) ○ (4) ○	(1) ○	(1) Refer to "Item No. 9-6. Confirmation of Insulation." (2) Make tightening. (3) Visually (4) If dust is found, absorb it by means of an electric cleaner.	(1) Be at 5MΩ and over. (2) & (3) Nothing shall be found abnormal.
	Connecting conductor	(1) Is conductor not deformed? (2) Are electric wires and covers not damaged and deteriorated (crack discoloration, etc.)?		○ ○		(1) & (2) Visually	(1) & (2) Nothing shall be found abnormal.
	Transformer reactor	Are no abnormal smell and noises perceived?	○			Visually, auditorily, and by smelling.	Nothing shall be found abnormal.
	Terminal board	Not damaged?		○		Visually	Nothing shall be found abnormal.
	Plain condenser	(1) Is no liquid leaking? (2) Is safety valve not projecting and not swelling? (3) Measurement of electrostatic capacity	(1) ○ (2) ○	(3) ○		(1) & (2) Visually (3) By means of electrostatic capacity measuring instrument	(1) & (2) Nothing shall be found abnormal. (3) 85% and over of rated capacity.
	Relay contactor	(1) Is no chattering preceived in couse of operation? (2) Is contact not found rough?		○ ○		(1) Auditorily (2) Visually	(1) & (2) Nothing shall be found abnormal.
	Resistor	(1) Is resistor insulation not cracked? (2) Confirmation of presence of disconnection		○ ○		(1) Visually (2) Measurement with a tester with one-side connection removed	(1) Nothing shall be found abnormal. (2) Be within an error of not over about ±10% of the indicated resistance.
Control circuit and Protection circuit	Action check	(1) Confirmation of balance of output voltages in each phase in inverter unit operation. (2) After sequence protection test, nothing abnormal shall be found in protection and display circuits.		○ ○		(1) Measure voltages between phases U, V, and W of inverter output terminals. (2) Short-circuit simulatedly between input terminal and common one of inverter control contact.	(1) Variation of voltages between terminals shall be less than 2% of the output voltage. (2) Check the action of the external sequence. It shall be found nothing abnormal.
	Parts check: General	(1) Are no abnormal smell and discoloration found? (2) Is no striking rust found?		○		(1) & (2) Visually	(1) & (2) Nothing shall be found abnormal.
	Parts check: Condenser	Are no liquid leakage and deformation left alone?	○			Visually	Nothing shall be found abnormal.
Cooling system	Cooling fan	(1) Are no abnormal vibration and noise perceived? (2) Is there no looseness in connections?	(1) ○	(2) ○		(1) Visually and auditorily. Set the power to OFF and turn it by hand. (2) Tighten it.	(1) Smooth rotation and no abnormal noise shall be observed. (2) Nothing abnormal shall be found.
Display	Display	(1) Is the lamp not burnt? (2) Cleaning	(1) ○	(2) ○		(1) Check to see if the panel lamp is on with the panel-fitted lamp test switch operated. (2) Clean it with waste cloths, etc.	(1) Check for its lighting.
	Meter	Is the indicated value normal?	○			Record the meter-indicated value of the panel.	Control values and prescribed values shall be satisfied.

E

SECTION E

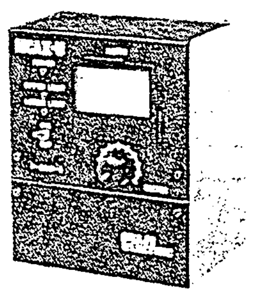
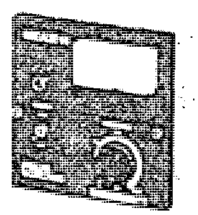
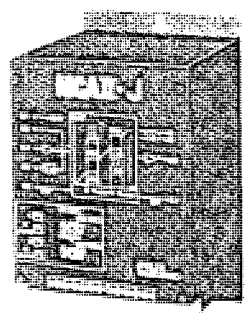
FAULT TRIP UNIT

FUJI MCA11-GFD-2 SERIES

SUPPLIED BY: EMSBY EQUIPMENT PTY LTD
33 ACHIEVEMENT CRESENT
ACACIA RIDGE QLD 4110
TEL: (07) 274 2566
FAX: (07) 274 2387

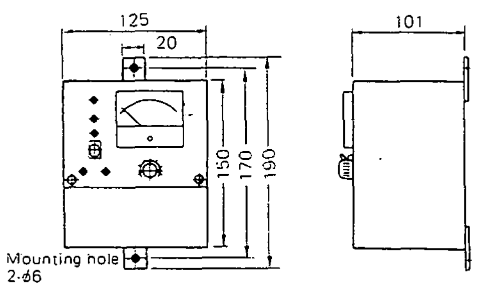
FUJI INVERTERS
MCA series
Auxiliary control equipment

Auxiliary control equipment MCA series
These MCA series equipment are used to carry out an automatic control of systems comprising inverter. They facilitate system control including conveyer synchronized operations, interlocking control, automatic operations using a sensor and winding control.
In addition, when the programmable controller is incorporated, the control circuit can be simplified.
For further information on MCA series, please contact FUJI.

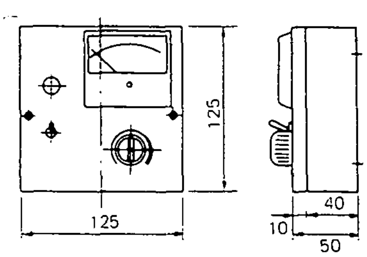
Sensor automatic controller	Frequency setter	Frequency jump unit	Signal controller
MCA II-U	**MCA II-H**	**MCA II-J**	**MCA-SA**
• Current/voltage conversion during automatic operation by sensor • PI control • Signal conversion for sensor • Output frequency limit • Sensor signal monitor • Power supply for sensor	• Potentiometer for frequency setting (1kΩ) • Frequency meter flush mounting type is available. Exclusive use: FRENIC5000 series	• Two jump frequencies can be set to prevent resonance. Exclusive use: FRENIC5000 series	• Main speed setting when running several inverters • Ratio setting • DC amplification • Current/voltage conversion • Sensor signal conversion
			

Dimensions, mm

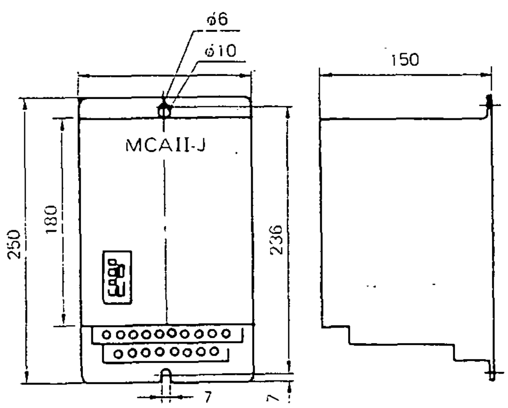
MCA II-U



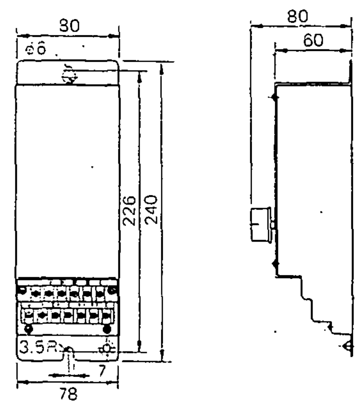
MCA II-H



MCA II-J



MCA-SA



F

SECTION F

LEVEL DISPLAY TRANSMITTER

LIT 500

CLIENT FREE ISSUE

DEC 10 '93 02:52PM DEPT WS & S FL 9 BAC 7 2256765 P.2/3

MANN INDUSTRIES PTY LTD

LPD350

LOOP POWERED INDICATOR

Description

The Mann Industries LPD350 loop powered display provides a local process indication from any 4-20mA signal.

The input measurement is shown on a large, 3 + 1/2 digit, high contrast LCD display and can be easily scaled to read in percentage or directly in engineering units.

Power for the unit is drawn from the input loop current with a 2.5V voltage drop across the unit (at 20mA current) which results in a maximum increase in loop load of 125Ω.

Mann Industries also manufacture a range of powered displays with analogue, RTD, thermocouple and frequency inputs (see catalogue section 6, PM350 series data sheets for details).

The LPD350 and the entire Mann Industries product range are designed and manufactured in Australia and carry a full 2-year warranty.

For more information or application assistance please contact your Mann Industries representative or Mann Industries manufacturing headquarters.

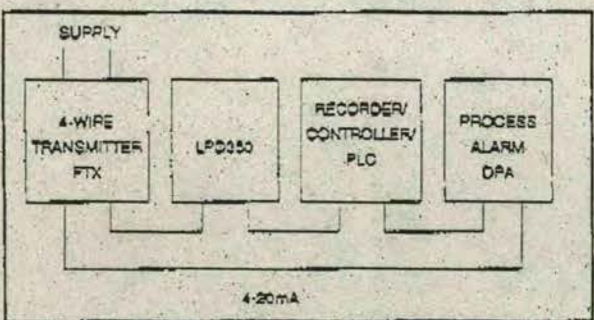


FIG 1: Use of LPD350 with 4-wire transmitter and process alarm module (Power for loop comes from 4-wire transmitter).

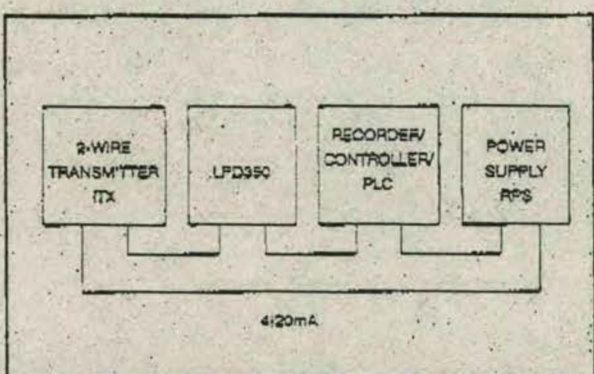


FIG 2: Use of LPD350 with 2-wire transmitter (note that it may be possible to power the loop from the PLC in which case the power supply will not be required).

Features

- Large 12.7mm (0.5") high contrast LCD display
- Accepts 4-20mA and 10-50mA inputs
- Loop powered (125Ω loop load)
- Linearity +/– 0.1% of span
- Easily scaled to display in any engineering unit
- Reverse action display internally selectable
- Screw connections via rear mounted unpluggable terminal block
- Rugged anodised aluminium case in standard 48 x 96mm DIN format
- Two year warranty
- Australian designed and manufactured

For assistance and advice on recent additions to our range of products please contact our marketing department.

See over for full specifications

ISSUE NO: LPD350 0390-A

SPECIFICATIONS

DISPLAY	: 3 + 1/2 digit LCD
Digit size	: 12.7mm (0.5 Inch)
Range	: −1999 to +1999
Decimal point selection (switch selectable)	: 1XXX 1.XXX 1X.XX 1XX.X
Overrange display	: Blanked except for 1 at left

Note : Minus sign is displayed automatically when measured signal is below display zero.

INPUT	: 4-20mA (or 10-50mA)
Voltage drop	: 2.5V @ 20mA
Max loop loading	: 125Ω
Max forward current	: 100mA continous 500mA for 10s
Max reverse current	: 500mA continous
ADJUSTMENTS	
Span adjustability	: 0 - 3998 counts in 3 switched ranges
Zero adjustability	: −1999 to +1999 in 2 switched ranges

Note : All adjustments via 20-turn potentiometers

POWER	: from input loop (see above)
GENERAL :	
Accuracy	: +/− 0.05% span error +/− 1 count
Repeatability	: +/− 0.05% span error
Temperature drift	: Zero +/− 0.1 counts /°C Span +/− 0.1 counts /°C
Operating temp range	: −20 to +70 °C
Storage temp range	: −25 °C to +85 °C
Response time	: 200mS from 10-90% output
Sample rate	: 2.5 per sec
DIMENSIONS : 1/8 DIN Standard	
Bezel	: 48mm x 96mm
Case depth	: 75mm
Cutout	: 44.25mm +/− 0.25mm x 92.25mm +/− 0.25mm

NOTES :

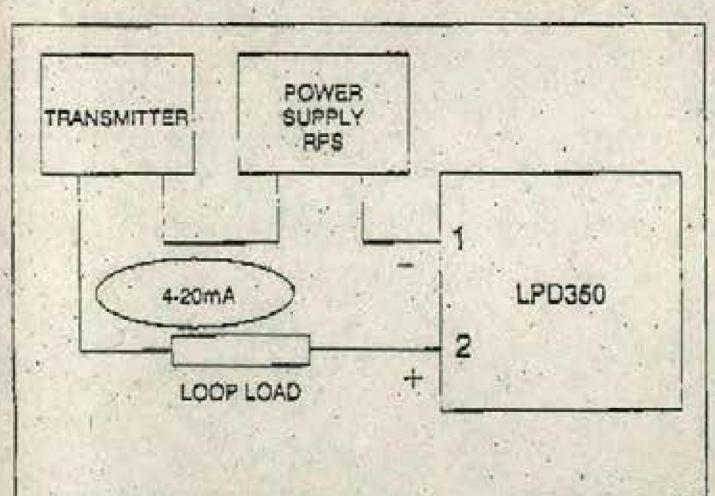


FIG 3: LPD350 connection diagram.

ORDERING INFORMATION

When ordering specify LPD350/1 /2 /3

Where :

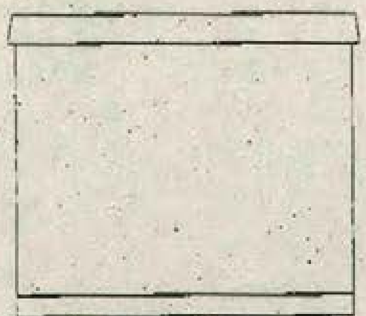
1. Input current range
2. Display range
3. Options : X = no option
   WP = Weatherproof housing

See also OPTIONS and ACCESSORIES section.

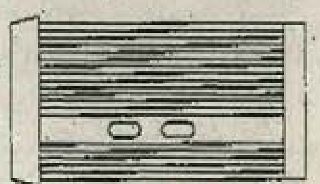
Example : LPD350/4-20mA/-50.0to +100.0/X

NOTES:

FRONT VIEW (48mm x 96mm)



TOP VIEW (96mm x 75mm excluding bevel)



SIDE VIEW (48mm x 75mm excluding bevel)

The thorough testing and quality control imposed by MANN INDUSTRIES PTY LTD on all their products minimises the risk of instrument failure: all items are fully warranted for two years. furthermore our design, production and sales staff are on hand to provide efficient backup and assist you in providing solutions to your process measurement and control problems.

MANN INDUSTRIES PTY LTD has an ongoing research and development program. Designs and specifications are therefore subject to change without notice. No liability will be accepted for errors omissions or amendments to this specification.

Designed and manufactured by
MANN INDUSTRIES PTY LTD
4/26 LEIGHTON PLACE,
HORNSBY,
NSW, AUSTRALIA
TEL: 61 2 477-5822 FAX: 61 2 477-5819

Distributed by

G

SECTION G

LOAD BREAK SWITCHES

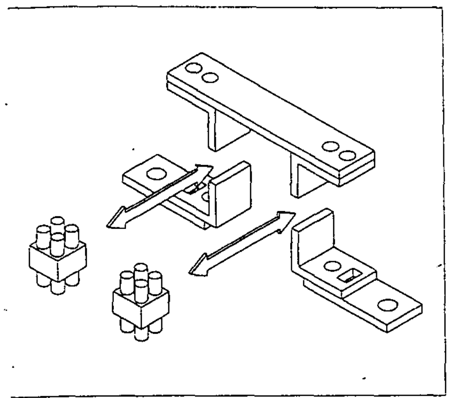
SPRECHER & SCHUH LK SERIES

LK LKP3-2500WT LOAD BREAK SWITCH
LK QSA200N BS FUSE SWITCH UNITS MECHANICAL INTERLOCK

SUPPLIED BY: NHP PTY LTD
25 TURBO DRIVE
COORPAROO QLD 4151
TELEPHONE: (07) 891 6008
FAX: (07) 891 6139

NHP-LK Rollcon & Visicon Load-Break Switches

Refer Catalogue NL

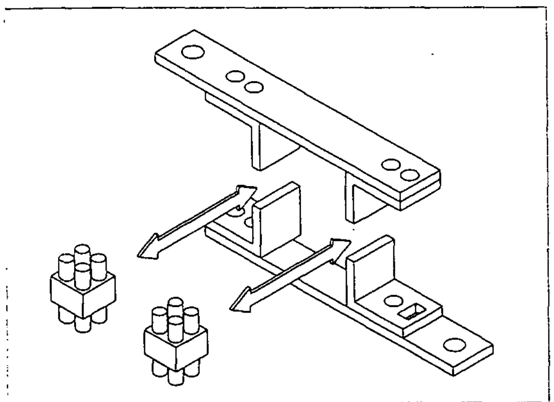


LKA - Fault make, motor load-break switches 125 amp - 1000 amp

For motor switching and general purpose loads

This style of switch is designed primarily for motor circuit applications, as it has a similar contact design to fuse-switches. It therefore has excellent motor/load (AC 23) characteristics due to the 4 series breaks per pole. The thermal ratings differ from those of the fuse-switches, as the LKA does not have to dissipate the watts loss of a fuse cartridge. This same contact arrangement makes it very suitable for special applications like capacitor or D.C. switching.

Fitted with IP65 handle as standard.



LKP - Fault make load-break switches 250 amp - 3150 amp

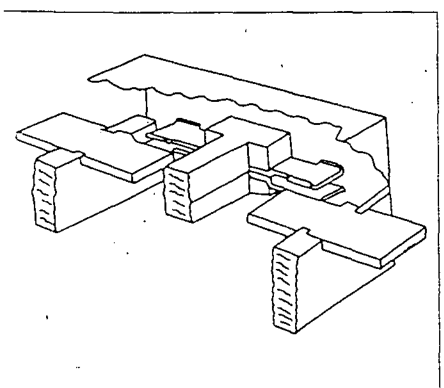
For general purpose loads

Arranging the contact pairs in parallel gives the LKP range significantly higher current capacity and short time withstand. For example, the largest rated switch is the LKP 3150 which can carry 3150 amps (enclosed) and has a short circuit withstand of **80kA for 1 second and 50kA for 3 seconds.**

Most of the LKP range have ratings for AC 22 (mixed loads) and AC 21 (mostly static loads).

This range is the most popular for general light and power duties and main switch / isolator application.

Fitted with IP65 handle as standard.



LKV - Fault make, motor load-break switches 40 amp - 3600 amp

For motor switching and general purpose loads

This new series of load-break switches has recently joined the NHP-LK series of switches. This 'V' series of switches, by the use of conventional wiping contacts offer a very shallow depth suited to circuit breaker panelboards.

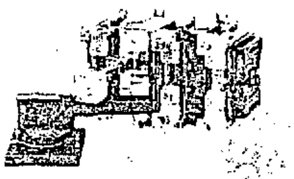
Another strong advantage of these switches is their visible contacts (125 to 1600 amp) which are required by many customers.

Supplied with IP65 handle as an option.

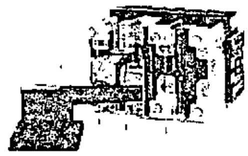
NHP-LK Rollcon Fuse - Switches
Type LKS

1

Refer Catalogue NL All prices include handle (IP65) and shaft as standard.	160A	200A	250A	315A	400A
	Frame size R2				



Cat. No. LKS2-200



Cat. No. LKS2-315-PI

Cat. No. LKS2-400

Standard fixed type fuse-switches	**LKS2-160** **$520.00** **LKS2-160-DIN** **$540.00**	**LKS2-200** **$620.00** - -	**LKS2-250** **$720.00** **LKS2-250-DIN** **$740.00**	**LKS2-315** **$820.00** - -	**LKS2-400** **$890.00** **LKS2-400-DIN** **$900.00**
Plug in fuse-switches for MCC applications suitable for IP20 cut-out	- -	**LKS2-200-PI** **$770.00**	**LKS2-250-PI** **$820.00**	**LKS2-315-PI** **$1010.00**	**LKS2-400-PI** **$1130.00**

Rated thermal current (Ith)		160 amps	200 amps	400 amps	400 amps	400 amps
Rated enclosed thermal (Ith_e)		160 amps	200 amps	250 amps	315 amps	400 amps
Rated operational current and typical motor loads to AS1775	415V, AC 23	160A 90kW	200A 116kW	250A 145kW	315A 185kW	400A 235kW
Fuse types to AS2005 ¹)	A.S., B.S.	B1, B2	B1, B2	B1 - B4	B1 - B4	B1 - B4
	DIN	00	-	1, 2	-	1, 2
Rated fused short circuit current - 500V AC kA RMS		100kA	100kA	100kA	100kA	100kA
Maximum fuse size amps		160A	200A	250A	400A	400A
DC operation -	2 poles in series 220V DC, DC 23	160A	200A	250A	315A	400A
	3 poles in series 440V DC, DC 23	160A	200A	250A	315A	400A
Outline dims. -	H mm	146	146	160	160	160
	W mm	240	240	240	240	240
	D (min) mm	220	220	220	220	220
	D (max) mm	270	270	270	270	270
Max. with longer shaft D mm		390	390	390	390	390

Enclosed (steel) surface mounted fuse-switches	- -	**LKS2-200-SE** **$1080.00**	**LKS2-250-SE** **$1190.00**	**LKS2-315-SE** **$1290.00**	**LKS2-400-SE** **$1350.00**
Enclosure type: Sarel Cat. No.	-	53025	53025	53025	53025

Notes: Prices for all switches include standard handle (IP65) and shaft.
Price excludes fuses.
For 'add on' neutral links and switched neutral blocks - Refer page 1 - 15.
¹) Refer page 1 - 18 for fuse types by manufacturer.

Enclosed surface mounted fuse-switch
Cat. No. LKS1-100-SE

Price Schedule 'B2'

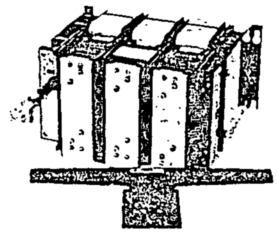
1

NHP-LK Rollcon Load-break Switches

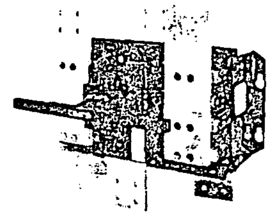
Type LKP

Refer Catalogue NL
All prices include handle (IP65) and shaft as standard

	1600A	2000A	2500A	2500A	3150A
	Frame R4		Frame size 2xR3 without terminal	Frame R4	



Cat. No. LKP4-2500WT

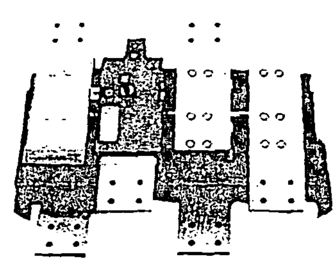


Cat. No. LKP4-3150

Cat. No.	LKP4-1600	LKP4-2000	LKP3-2500WT [1]	LKP4-2500	LKP4-3150
Price $	$4750.00	$4950.00	$4500.00	$5320.00	$6900.00

Rated thermal current (Ith)	1600 amps	2000 amps	2500 amps	2500 amps	3150 amps
Rated enclosed thermal (Ith_e)	1600 amps	2000 amps	2500 amps	2500 amps	3150 amps [2]
Rated operational current and typical loadings to AS1775					
500V AC, AC 22	800A	-	-	-	-
660V AC, AC 21	1600A	2000A	2500A	2500A	3150A
Rated protected short circuit current - 500V AC kA RMS	100kA	100kA	100kA	100kA	100kA
Maximum breaker size amps	1600A	2000A	2500A	2500A	3150A
Short-time withstand current					
[1 sec. kA RMS]	63kA	80kA	80kA	80kA	80kA
[3 sec. kA RMS]	-	50kA	50kA	50kA	50kA
Outline dims. - H mm	463	463	225	463	463
W mm	500	526	389	526	596
D (min) mm	245	245	374	245	245
D (max) mm	-	-	399	-	-
Max. with longer shaft D mm	550	550	699	550	550

Notes: Price for all switches include standard handle (IP65) and shaft.
[1]) Without terminal.
[2]) I_{the} - 3150A in a ventilated enclosure / I_{the} - 2800A when totally enclosed.



LKP4-3150-4P
All multi-box switches are available in 4 pole format on indent.

Price Schedule 'B2'

Arc D-Tect
Arc Detecting Relay System

Refer Catalogue LKC

Arc fault protection of switchboards

The arc detecting relay system is designed to reduce the effects of arcing faults in high and low-voltage switchboards. These faults are serious especially in switchboards with high short circuit currents and long overload tripping times. The system can be used in enclosed as well as in open installations.

By means of light sensitive detectors suitably placed inside the switchboard, the relay almost instantaneously upon the ignition of an arc generates a tripping pulse to the circuit breakers supplying the busbars.

Laboratory tests have proved that the tripping pulse is generated less than 1mSec. after ignition of the arc. The arcing time is thus reduced to the operating time of the circuit breaker which is normally in the range of 20 - 70mSec. This should be compared to typical overload tripping times of 0.5 - 1.5 Secs. (A reduction to as low as 0.4% to 14%).

The use of the system has several advantages:

1. Danger to personnel is avoided. Due to the short arcing time, excessive pressure does not develop inside the switchboard and doors etc. stay in place.
2. Personal injury and eye damage from hot gas blasts are unlikely, since pressure build-up is minimal and the time of intensive light is short.
3. Switchboard damages, both thermal and mechanical, are greatly reduced. Normally the installation can be operated again after cleaning and minor repairs.

ARC Detecting relay

The **Arc D-Tect** relay is designed to operate all commercially available trip coils. Inside the relay, input and output circuits are electrically separated by means of an opto-coupler. The relay is completely solid state and contains no moving parts. It is resistant to mechanical shock as a result of the operation of the switchboard.

Technical details are available on a separate technical catalogue. Refer Catalogue LKC.

Detector cells

The detectors consist of two silicon photo-voltaic cells.

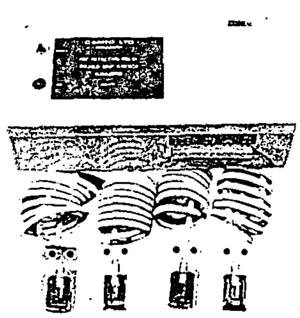
The cells generate an open circuit voltage of approx. 400 mV when exposed to light and the resultant current is directly proportional to light intensity.

The detector is encapsulated in transparent polyester which is self-extinguishing. The detector is supplied in two types both with the same dimensions.

Mode of operation

When one or more of the detectors connected in parallel is exposed to light, an output current is generated from each detector illuminated. If the sum of these currents exceeds the input bias current of the relay, the output thyristor is fired via the opto-coupler and the trip coil is energised.

System choices



Arc detection relay

Description		Cat No.	Price $
Arc D-Tect relay 240V AC capacitor discharge trip		ADR-1	1200.00
Arc D-Tect relay 48-220V DC voltage control type		ADR-2	830.00
Arc D-Tect relay 24V DC voltage control type	[i]	ADR-3	830.00
Arc D-Tect relay 32V DC voltage control type	[i]	ADR-4	830.00
Type V encapsulated detector		ADR-V	350.00
Type H encapsulated detector		ADR-H	350.00
Optional accessories			
Junction box per 6 detectors	[i]	ADR-JB	160.00
Indicating junction box (6 detectors)	[i]	ADR-IB	450.00
Diode logic box (multiple relays)	[i]	ADR-LB	280.00

Note: [i] Available on indent only.

NETT

HI

SECTION H

CIRCUIT BREAKERS

TERASAKI
XS-400CJ/400-AX CIRCUIT BREAKER
XS-800NE/800-AX-LSI CIRCUIT BREAKER

SUPPLIED BY: NHP PTY LTD
25 TURBO DRIVE
COORPAROO QLD 4151
TELEPHONE (07) 891 6008
FAX (07) 891 6139

TERASAKI
Ensuring Service. Maintaining Quality

Catalogue
120A
October 1991

Economical Series

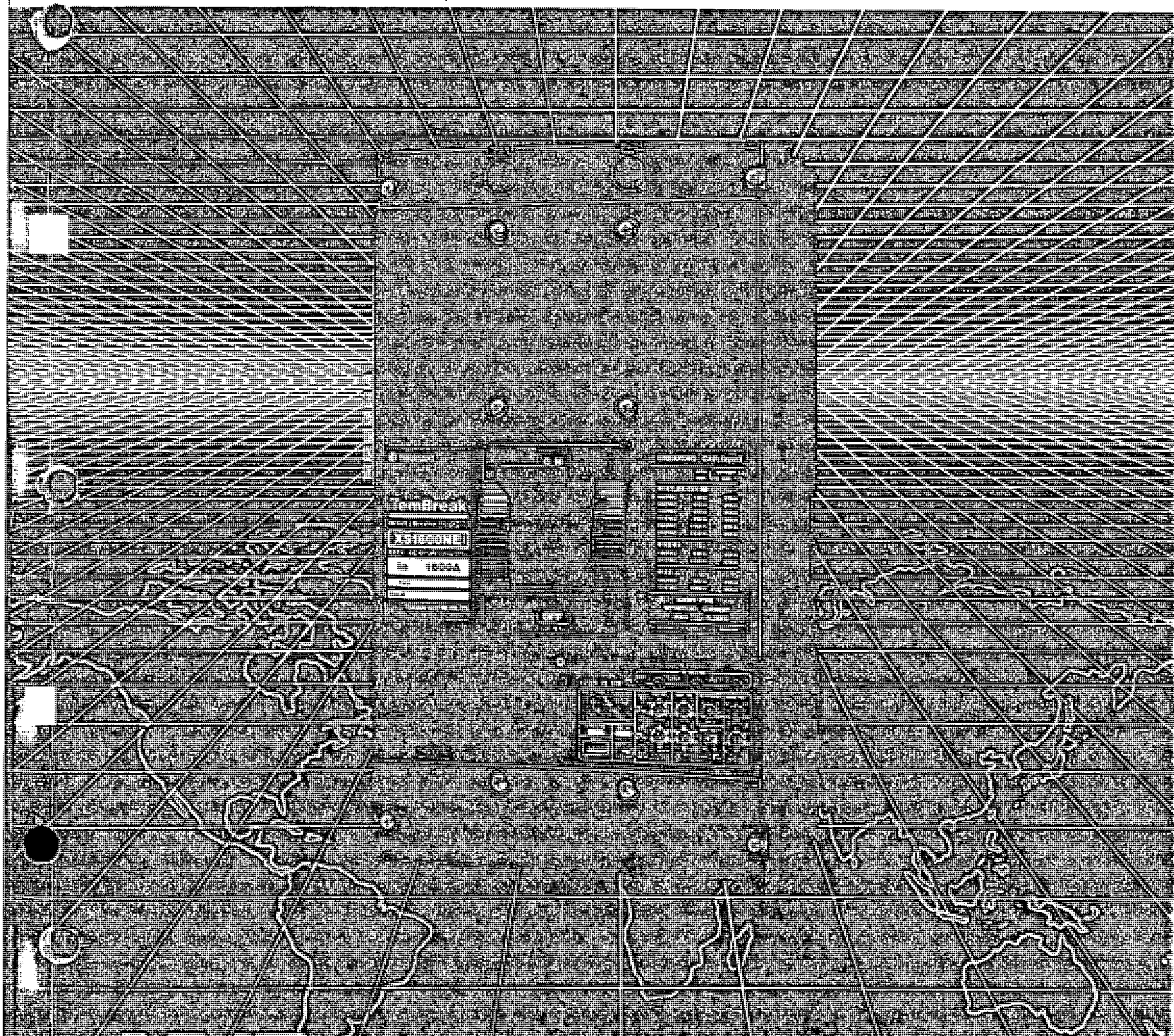
Standard Series

High-fault Level Series

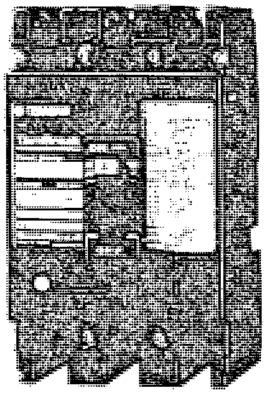
Non-automatic Series

TemBreak

Total Protection, Complete Control



NHP ELECTRICAL ENGINEERING PRODUCTS PTY LTD



4

Characteristics and Outline Dimensions

TemBreak

High-fault Level Series

XH125NJ

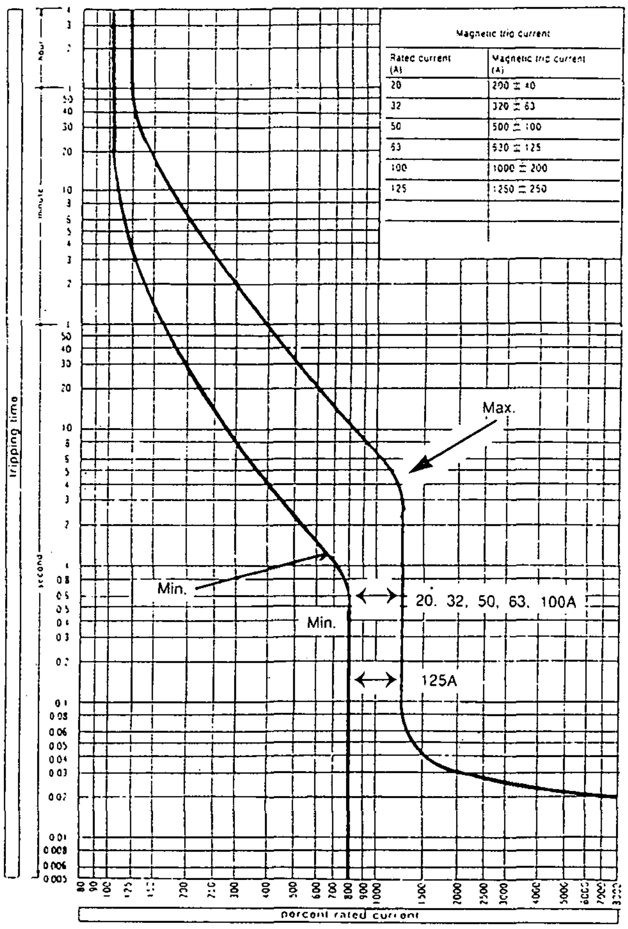
(125A Frame)

Ratings and Specifications

NUMBER OF POLES	3	4
RATING	NCR	ASR Min / Max
RATED CURRENT (In) Calibrated at 40°C for General use, 45°C for Marine use	20 32 50 63 100 125	12.5 / 20 20 / 32 32 / 50 40 / 63 63 / 100 80 / 125
Rated Insulation Voltage (Ui) AC	690	
Rated Insulation Voltage (Ui) DC	250②	
AC Rated Breaking capacity sym. r.m.s. (kA)	—	
IEC 947-2 [Icu] / IEC 947-2 [Ics] BS 4752 [P-1] CEI 17-5 [P-1] AC 690V	8/4	
660V	3/4	
500V	25/13	
440V	42/21	
415V	50/25	
400V	50/25	
380V	50/25	
240V	85/43	
AS 2184 440V	50	
415V	50	
NEMA AB-1 AC 600V	25	
480V	42	
240V	85	
DC Rated Breaking Capacity (kA) 250V	40	
125V	40	
Weight (kg) ⊙Marked Standard type	1.3	1.58
CONNECTIONS AND MOUNTINGS		
front connected (FC) terminal screw	⊙	
attached flat bar	—	
solderless terminal (PWC)	○	
rear connected (RC) bolt stud	○	
flat bar stud	—	
plug-in (PM) for switchboard	○	
for distribution board	○	—
draw-out (DO)	—	
STANDARD FEATURES		
Contact Indicator	●	
Trip button	●	
PROTECTIVE FUNCTIONS		
thermal and fixed magnetic trips	—	
thermal and adjustable magnetic trips	—	
adjustable thermal and fixed magnetic trips	●	
adjustable thermal and magnetic trips	—	
ACCESSORIES (option) CODE		
externally mounted motor operator MOT	●	
external operating handle panel mounted type OHE	●	
breaker mounted type OHG	●	
variable depth type OHH	●	
extension handle EHA	—	
mechanical interlock front type MIF	●	
rear type MIB	●	
handle holder HH	●	
handle lock HL	●	
terminal cover front connect type TCF	●	
rear connect/plug in type TCR	●	
interpole barrier TBA	●	
accessory lead terminal LTF	●	
door flange DF	●	

(Refer to Notes, opposite page)

Time/Current characteristic curves

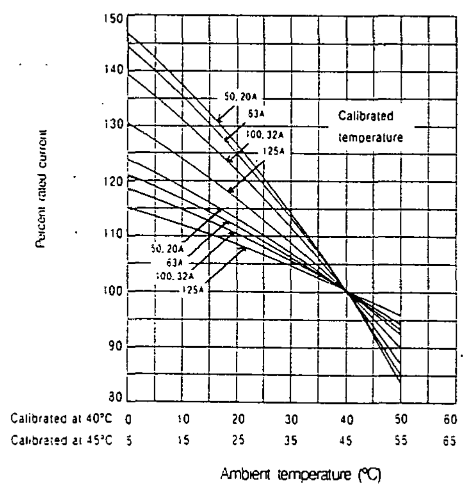


Magnetic trip current

Rated current (A)	Magnetic trip current (A)
20	200 ± 40
32	320 ± 63
50	500 ± 100
63	630 ± 125
100	1000 ± 200
125	1250 ± 250

NOTE: The magnetic current is calibrated at 13 x In not at 10 x In as indicated in the Time/Current characteristic curve.
Please consult Terasaki for further details.

Ambient compensating curves



Combinations of Internally Mounted Accessories

No. Pole	AXE auxiliary switch	ALE alarm switch	SHT shunt trip *1	UVT undervoltage trip *2	AXE ALE	AXE SHT	AXE UVT	ALE SHT	ALE UVT	AXE ALE SHT	AXE ALE UVT
3, 4											

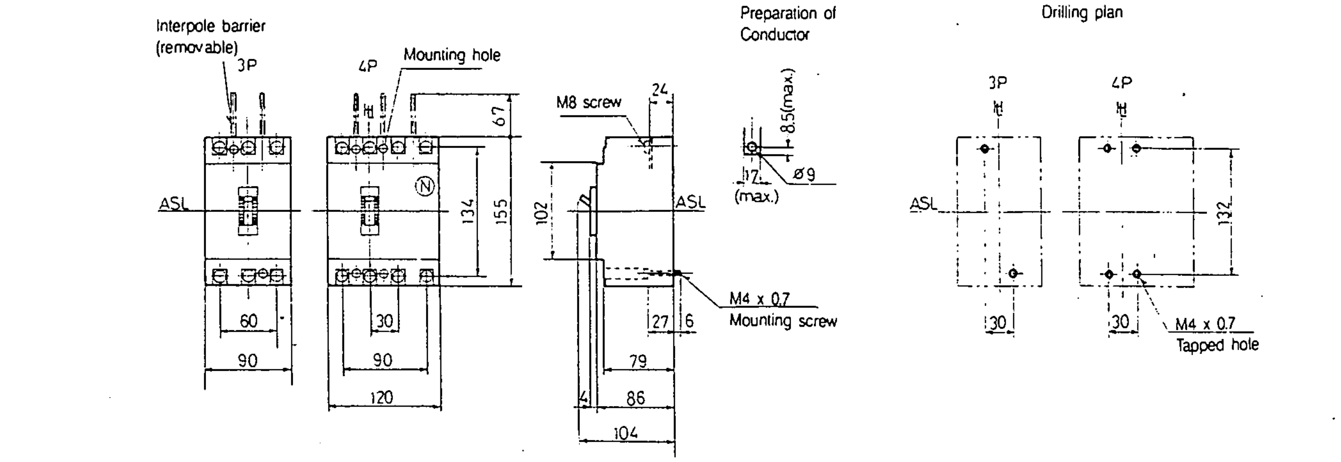
Handle — Left pole, Right pole

NOTE: *1: Shunt trip is provided with anti-burnout switch
*2: The UVT controller is installed externally, when provided with AC UVT.

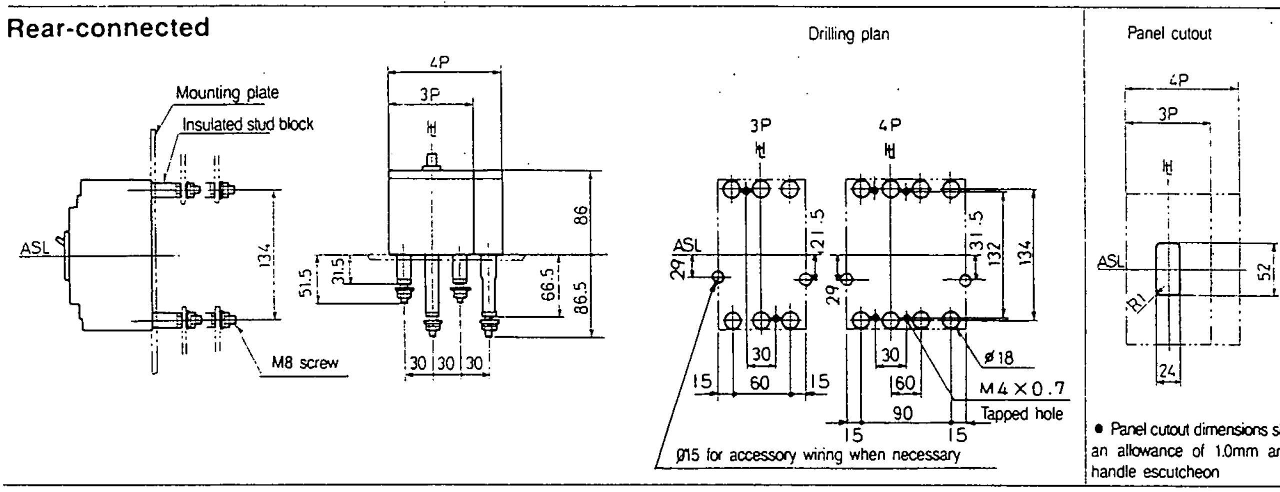
ASL: Arrangement Standard Line
H_L: Handle Frame Centre Line

Outline dimensions (mm) XH125NJ

Front-connected

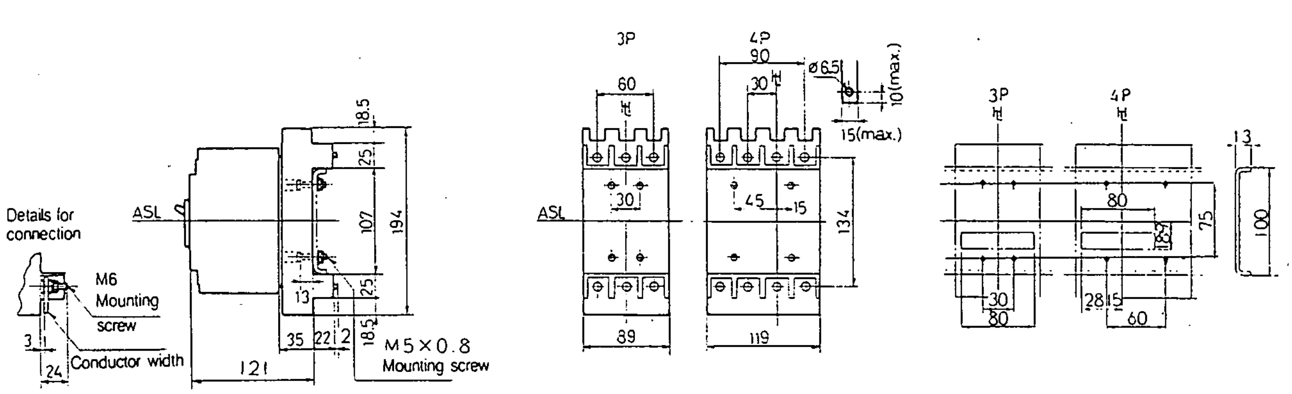


Rear-connected

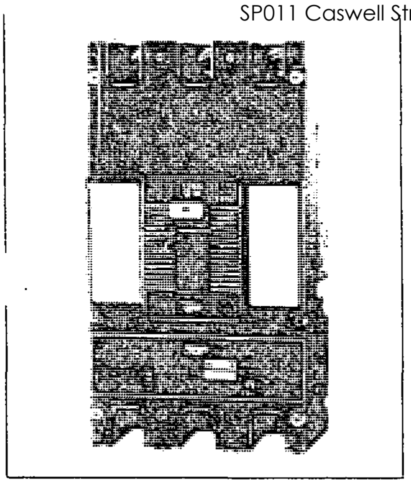


- Panel cutout dimensions should give an allowance of 1.0mm around the handle escutcheon

Plug-in



NOTES: ⊙ Standard. This configuration is used unless otherwise specified.
○ Optional standard. Specify when ordering.
● "yes" or "available"
— "no" or "not available"
② Special Specification



Characteristics and Outline Dimensions

TemBreak — Standard Series

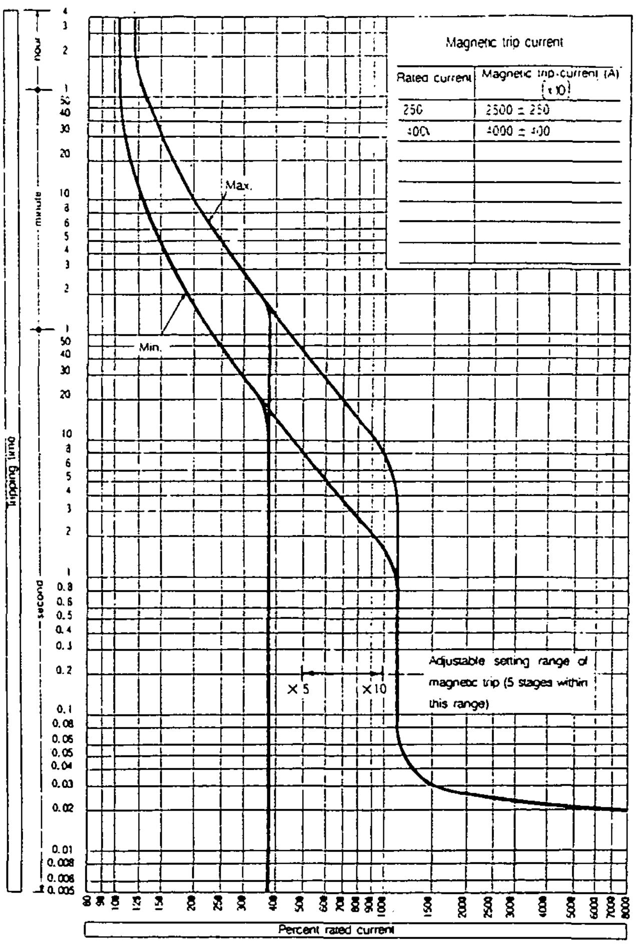
XS400CJ (400A Frame)

Ratings and Specifications

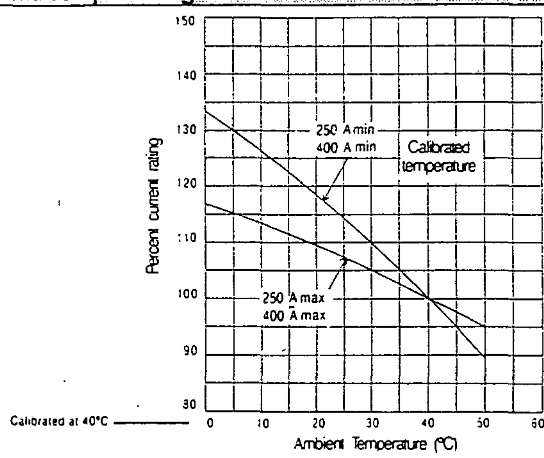
NUMBER OF POLES		3	4
RATING		NCR	ASR
RATED CURRENT (In)			min / max
Calibrated at 40°C for General use		250	160 / 250
45°C for Marine use		400	250 / 400
Rated Insulation Voltage (Ui)	AC	690	
	DC	250 ②	
AC Rated Breaking capacity sym. r.m.s. (kA)			
IEC 947-2 (Icu) / IEC 947-2 (Ics), BS 4752 (P-1), CEI 17-5 (P-1)	AC 690V	16/8	
	660V	16/8	
	500V	22/11	
	440V	30/15	
	415V	30/15	
	400V	35/18	
	380V	35/18	
	240V	50/25	
AS 2184	440V	36	
	415V	36	
NEMA AB-1	AC 600V	22	
	480V	30	
	240V	50	
DC Rated Breaking Capacity (kA)	250V	40	
	125V	40	
Weight (kg) ○Marked Standard type		4.7	6.1
CONNECTIONS AND MOUNTINGS			
front connected (FC)	terminal screw	○	
	attached flat bar	○(BAR)	
	solderless terminal (PWC)	○	
rear connected (RC)	bolt stud	—	
	flat bar stud	○	
plug-in (PM)	for switchboard	○	
	for distribution board	—	
draw-out (DO)		○	
STANDARD FEATURES			
Contact Indicator		•	
Trip button		•	
PROTECTIVE FUNCTIONS			
thermal and fixed magnetic trips		—	
thermal and adjustable magnetic trips		—	
adjustable thermal and fixed magnetic trips		—	
adjustable thermal and magnetic trips		•	
ACCESSORIES (option)	CODE		
externally mounted — motor operator	MOT	•	
external operating handle — panel mounted type	OHE	•	
breaker mounted type	OHG	•	
variable depth type	OHH	•	
extension handle	EHA	—	
mechanical interlock — front type	MIF	•	
rear type	MIB	•	
handle holder	HH	•	
handle lock	HL	•	
terminal cover — front connect type	TCF	•	
rear connect/plug in type	TCR	•	
interpole barrier	TBA	•	
accessory lead terminal	LTF	•	
door flange	DF	•	

(Refer to Notes, opposite page)

Time/Current characteristic curves



Ambient compensating curves



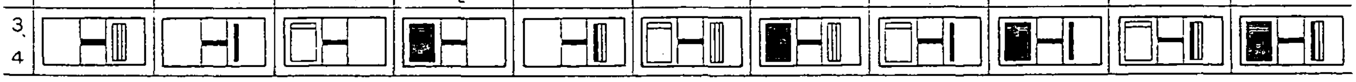
Magnetic trip current (adjustable)

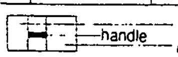
Rated Current (A)	Magnetic trip current (A) In × 10	8.5	7	6	5
250	2500	2125	1775	1500	1250
400	4000	3400	2840	2400	2000

NOTE: Setting tolerance ± 10% in (x10) setting and ± 25% in (x5) setting

Combinations of Internally Mounted Accessories

No. Pole	AX auxiliary switch	AL alarm switch	SHT shunt trip *1	UVT undervoltage trip *2	AX + AL	AX + SHT	AX + UVT	AL + SHT	AL + UVT	AX + AL + SHT	AX + AL + UVT
3, 4											



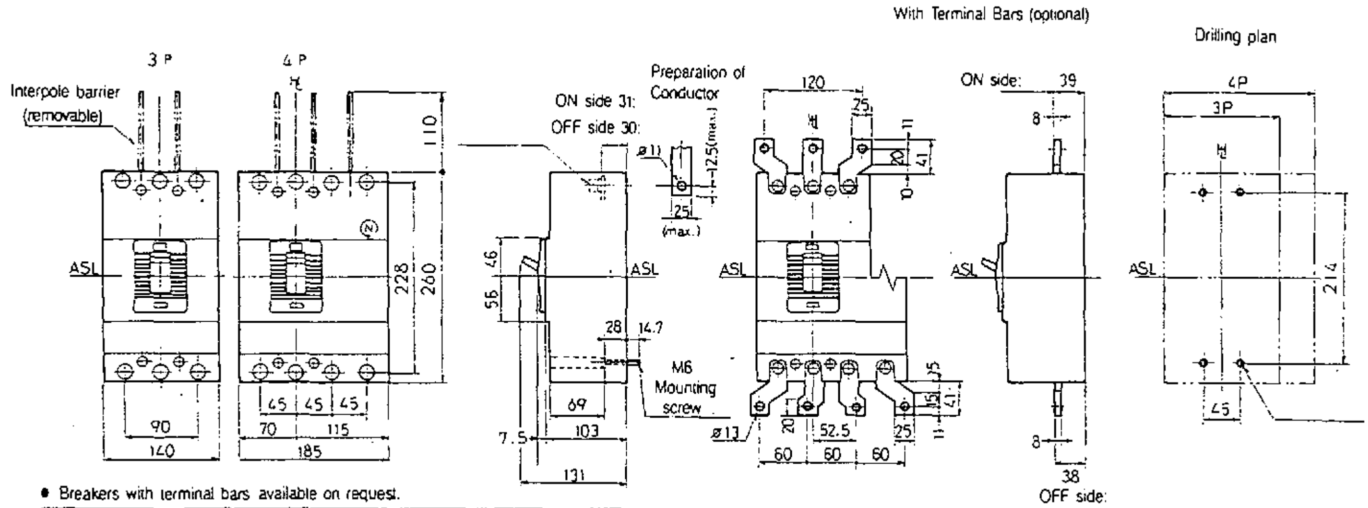


NOTE: *1: Shunt trip is provided with anti-burnout switch
*2: The UVT controller is installed externally when provided with A.C. UVT.

ASL: Arrangement Standard Line
Ħ: Handle Frame Centre Line

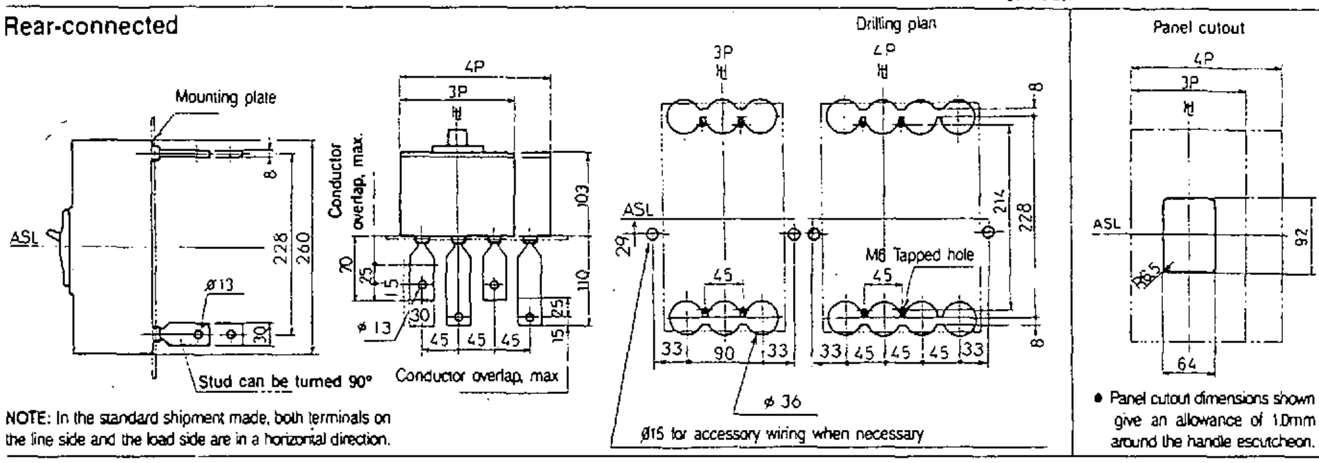
Outline dimensions (mm) XS400CJ

Front-Connected



• Breakers with terminal bars available on request.

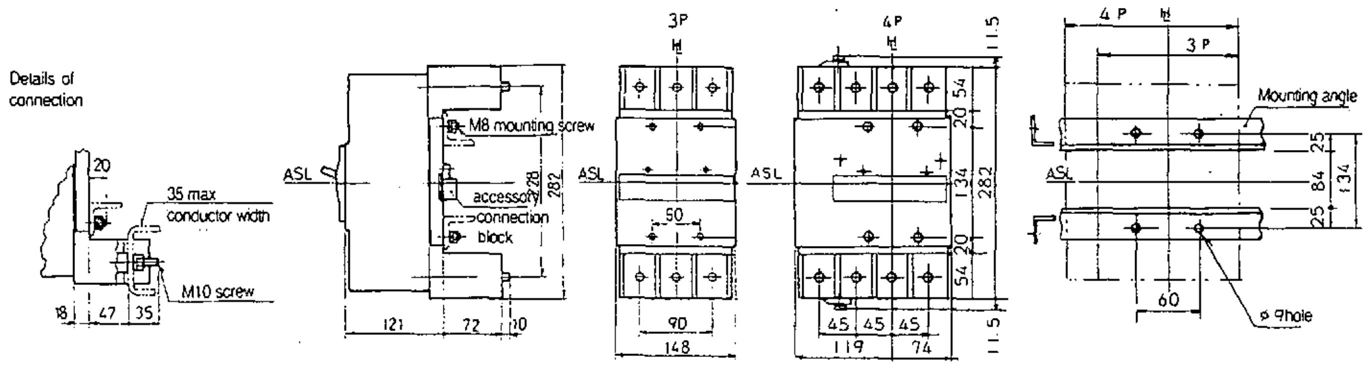
Rear-connected



NOTE: In the standard shipment made, both terminals on the line side and the load side are in a horizontal direction.

• Panel cutout dimensions shown give an allowance of 1.0mm around the handle escutcheon.

Plug-in

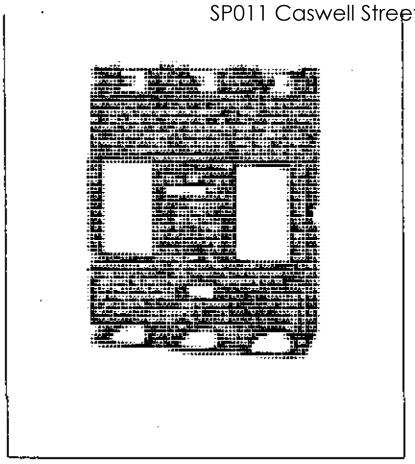


NOTES: ⊙ Standard. This configuration is used unless otherwise specified.
○ Optional standard. Specify when ordering.
• "yes" or "available"
— "no" or "not available"
② Special Specification

4 Characteristics and Outline Dimensions

TemBreak Standard Series

XS800NE Electronic type (800A Frame)

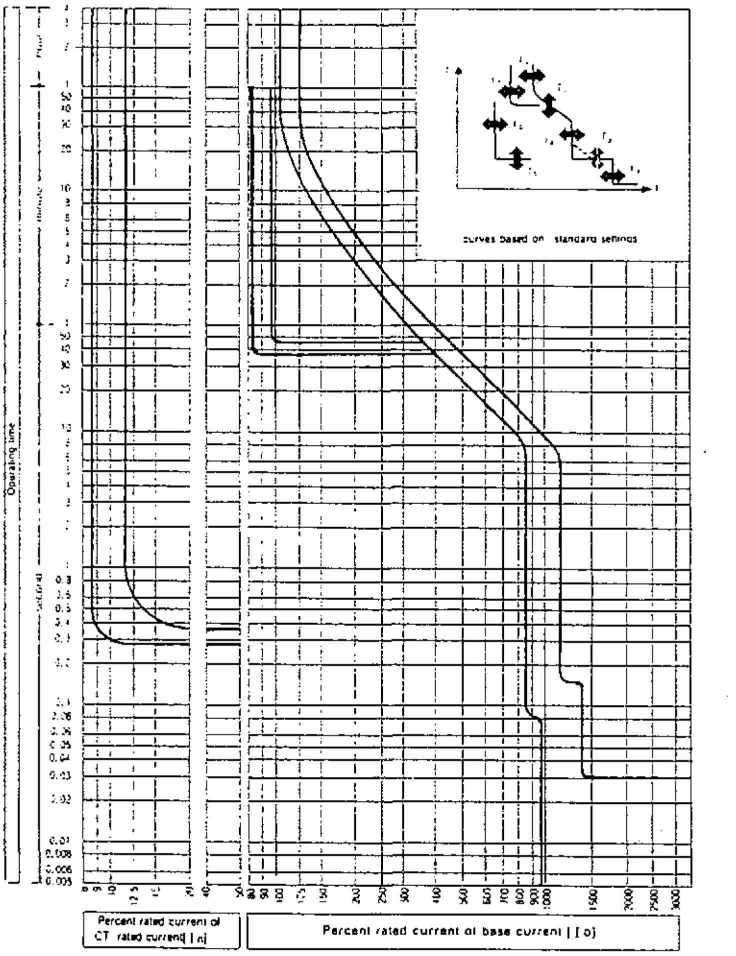


Ratings and Specifications

number of poles		3 | 4
RATED CURRENT (In)		NRC | ASR
· Calibrated at 40℃ or 45℃		min. max.
		800 | 400 | 800
NRC: Nominal Rated Current ASR: Adjustable Setting Range		
A.C. RATED INSULATION VOLTAGE (Ui)		690
A. C. RATED BREAKING CAPACITY · sym r. m. s.(kA)		
IEC 947-2(Icu) / IEC 947-2(Ics)	690V	20/10
BS 4752-1(P-1) /	660V	20/10
CEI 17-5(P-1) /	500V	35/18
	440V	50/25
	415V	50/25
	400V	50/25
	380V	50/25
	240V	85/43
AS 2184	440V	50
	415V	50
NEMA AB-1	600V	30
	480V	50
	240V	85
without inst	240V-690V	10
D.C. RATED	250V	—
BREAKING CAPACITY (kA)	125V	—
RATED SHORT-TIME CURRENT r.m.s. (kA) (Icw)		10 (0.3 sec)
Weight (kg) ◯ marked standard type		9.6 | 12.5
CONNECTIONS & MOUNTINGS		
front connected(FC)	terminal screw	—
	attached flat bar	◯
	solderless terminal(PWC)	◯
rear connected(RC)	bolt stud	—
	flat bar stud	◯
plug-in(PM)	for switchboard	◯
	for distribution board	—
draw-out(DO)		◯
STANDARD FEATURES		
contact indicator		●
trip button		●
PROTECTIVE FUNCTIONS (Electronic type)		
Adjustable LTD, STD & INST		●
Adjustable GFT or Adjustable PTA (option)		●
trip indicators(option)		—
ACCESSORIES(option)	CODE	
externally mounted — motor operator	MOT	●
external operating handle — panel mounted type	OHE	●
external operating handle — beaker mounted type	OHG	●
external operating handle — variable depth type	OHH	●
extension handle	EHA	●
mechanical interlock — front type	MIF	●
mechanical interlock — rear type	MIB	●
handle holder	HH	●
handle lock	HL	●
terminal cover — front-connected type	TCF	●
terminal cover — rear-connected type plug-in type	TCR	●
interpole barrier	TBA	●
accessory lead terminal	LTF	●
door flange	D · F	●

(Refer to Notes, opposite page)

Time/Current characteristic curves



Over-current tripping characteristics

CT rated current (A): (I n)	800
Base current setting (A): (I o)	(I n)×(0.63·0.8·1.0)
Long time delay pickup current (A): (I 1)	(I o)×(0.8·0.85·0.9·0.95·1.0) Non-tripping at (I 1) setting ×105% and below. Tripping at 125% and above.
Long time delay time setting (S): (T1)	(5·10·15·20·30) at (I 1)×600% current Setting tolerance: ±20%
Short time delay pickup current (A): (I 2)	(I o)×(2·4·6·8·10) Setting tolerance: ±15%
Short time delay time setting (S): (T2)	Opening time (0.1·0.15·0.2·0.25·0.3) in the definite time-delay. Total clearing time is +50ms and resettable time is −20ms for the time delay setting.
Instantaneous trip pickup current (A): (I 3)	Continuously adjustable from (I o)×(3 to 12) Setting tolerance: ±20%
※Pre-trip alarm pickup current (A): (I P)	(I 1)×(0.7·0.8·0.9·1.0) Setting tolerance: ±10%
※Pre-trip alarm time setting (S): (TP)	40 fixed definite time-delay, Setting tolerance: ±10%
※Ground fault trip pickup curent (A): (I G)	Continuously adjustable from (In)×(0.1 to 0.4) Setting tolerance: ±15%
※Ground fault trip time setting (S): (TG)	Opening time (0.1·0.2·0.3·0.4·0.8) in the definite time-delay. Total clearing time is +50ms and resettable time is −20ms for the time-delay setting.

※: Option
• : The underlined values will be applied as standard rating unless otherwise specified when ordering.

Combination of internally mounted accessories

No Pole	AX auxiliary switch	AL alarm switch	SHT shunt trip ※1	UVT undervoltage trip ※2	AX / AL	AX / SHT	AX / UVT	AL / SHT	AL / UVT	AX / AL / SHT	AX / AL / UVT
3 4											

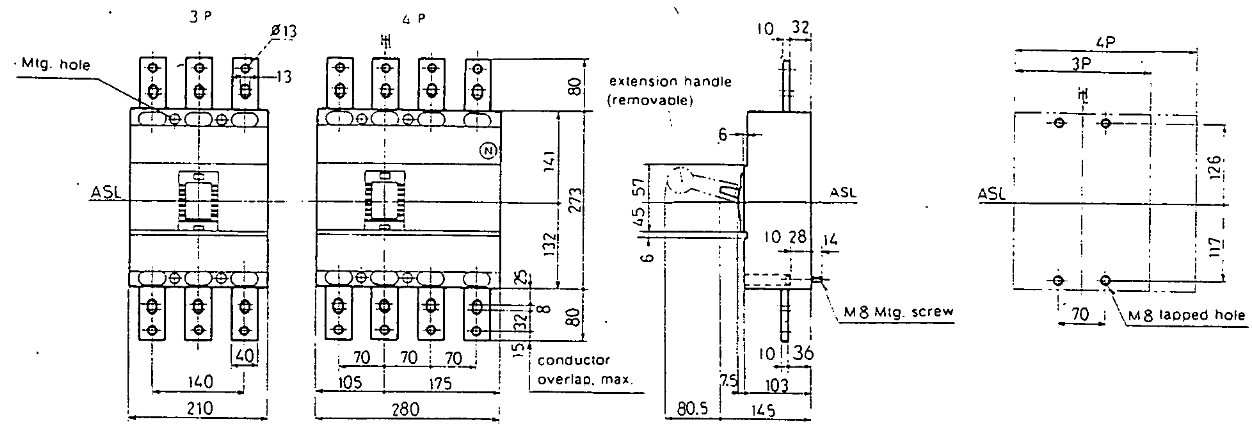
Left pole — Handle — Right pole

Note : ※1 :Shunt trip is provided with anti-burnout switch.
※2 : The UVT controller is installed externally, when provided with a. c. UVT.

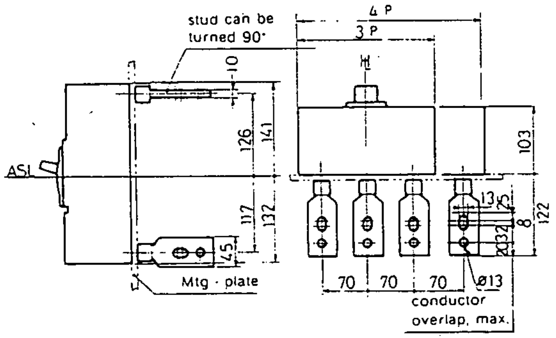
ASL: Arrangement Standard Line
ℍ: Handle Frame Centre Line

Outline dimensions(mm) XS800NE

Front-connected

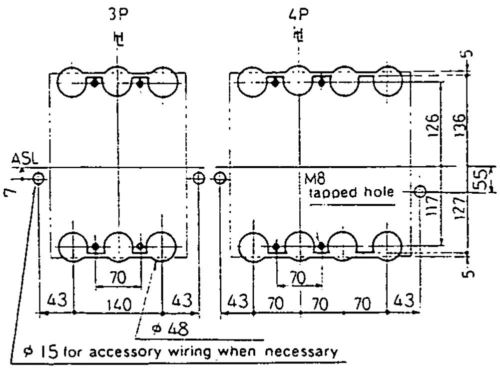


Rear-connected

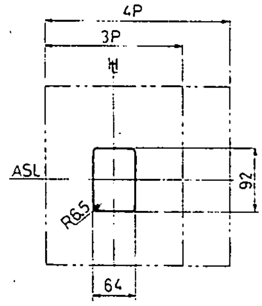


Note: In the standard shipment mode, both terminals on the line side and the load side are in horizontal direction.

Drilling plan

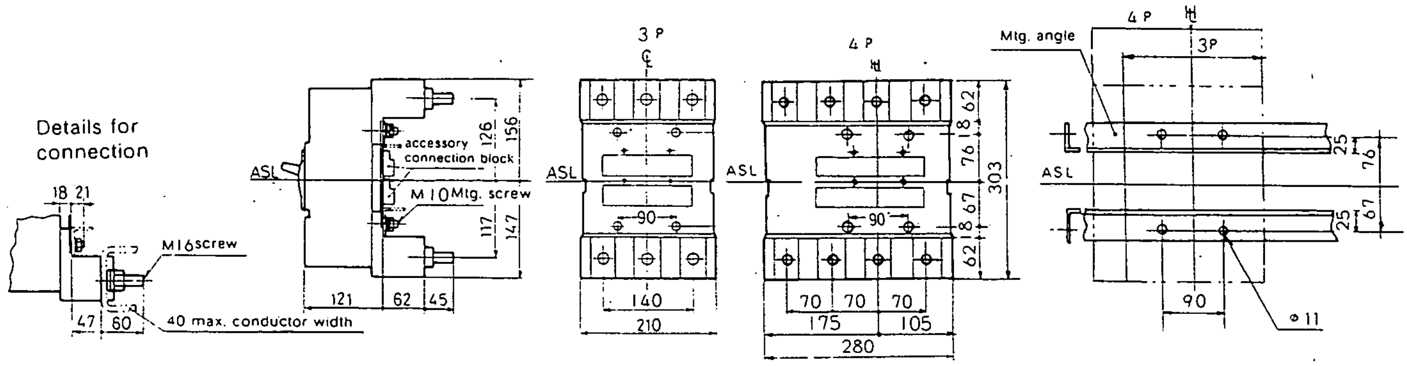


Panel cutout



- Panel cutout dimensions shown give an allowance of 1mm around the handle escutcheon.

Plug-in



NOTES: ⊙ Standard. This configuration is used unless otherwise specified.
○ Optional standard. Specify when ordering.
● "yes" or "available".
— "no" or "not available".

SECTION I

MINIATURE CIRCUIT BREAKERS

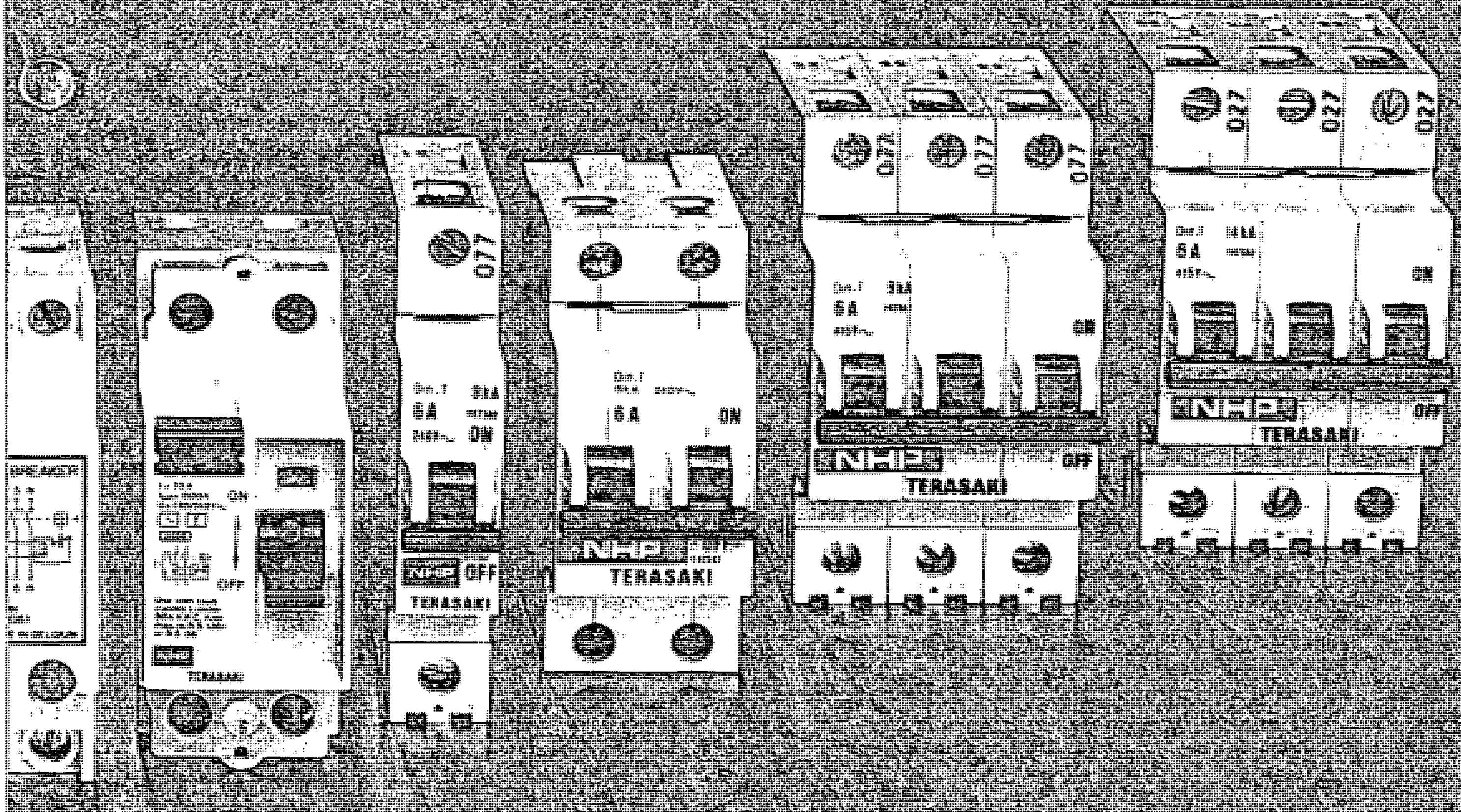
TERASAKI
DIN - T6 SERIES CIRCUIT BREAKERS

SUPPLIED BY: NHP PTY LTD
25 TURBO DRIVE
COORPAROO QLD 4151
TELEPHONE (07) 891 6008
FAX (07) 891 6139

NHP

PRICE LIST
CATALOGUE
DIN - 2
OCTOBER 1989

TERASAKI Din - T



NHP ELECTRICAL ENGINEERING PRODUCTS PTY LTD

GENERAL FEATURES —

Advantages of the new Miniature Circuit Breakers Din-T Series

- ***Short-circuit breaking capacity of up to 14kA at 415V AC. • Increased rating to 50kA when backed up with a 200A HRC fuse. (N.B. Max. fuse I^2t let through must be $1x10^5A^2S$ pre arcing).***
- ***Rated current range from 0.5A up to 63A.***
- ***Silver graphite (AgC) contacts.***
- ***Input connection by lifting terminal with capacity of up to 35mm² giving fast and practical connection.***
- ***Output terminals offer finger and hand protection with a capacity of up to 25mm².***
- ***Mounting by a new design of snap fixing with two stop locations, for normal Din rail.***
- ***Approval number V87382 - 11/1987.***
- ***Complies to AS 3111 and AS 2184.***

1. Brief Description

The Din-T series miniature circuit breakers have delayed thermal and instantaneous magnetic trips, with sealed adjustment; suitable for mounting in distribution boards or in switchgear panels.

2. Task

Protection against overheating of electrical conductors against excess currents due to overload, short-circuit or earth fault (if combined with earth-leakage module).

3. Application

In switching, control, distribution and measurement systems for buildings, commercial and industrial installations.

4. Tripping characteristic

Characteristics as required by Australian standards, (following European type U) tripping curves for cable and equipment protection in commercial and industrial applications. See Technical Data page.

Handle:
Sealable and padlockable with quick-make and quick-break type mechanism for 14kA model. Handle sealable in ON and OFF position. Due to the free tripping mechanism, the MCB contacts open through overload or short-circuit even when the handle is sealed in the ON position on all types.

Input terminal:
Box type terminal with lifting screw for copper and aluminium conductors:
min. capacity 1 mm²
max. capacity 1x35mm² or 2x16mm².
When unscrewing the screw, the head lifts; however, on pushing the screw head, the box terminal and the screw sink. This system enables the MCB's to be linked with a non-insulated wire or a connection strip very easily.
The MCB is delivered with a half open box terminal and a lifted screw head. A protection cap is fixed onto the MCB in order to obtain IP-20 protection against finger contact.

Output terminal
Box type terminal with captive terminal screw for copper and aluminium conductors:
min. 1 mm² max. 1x25 mm² or 2x10 mm².
The box terminals are always delivered in the open position. Output terminals are always supplied with IP-20 protection against direct finger contact by means of an insulating cover.

Arc chamber:
Contains arc extinction plates, de-ionising type, designed to break up and dissipate the arc which is generated during interruption of all types of fault.

Arc magnetic blowout system.
Short-circuit currents do not flow through the bimetal but are directed by the blowout magnet, in such a way that the arc is transferred to a special arc runner, therefore taking the bimetal out of the circuit which ensures the trip characteristics remain unchanged.

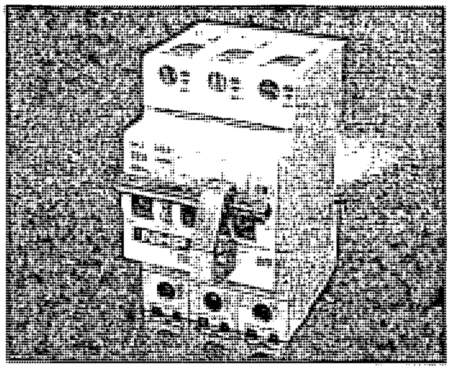
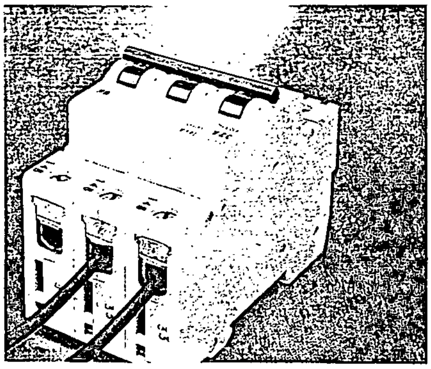
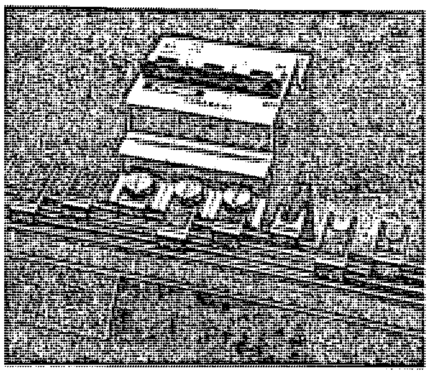
Electromagnet:
Operating the plunger which opens the contacts instantaneously.

- *The combination of the electromagnet (with a plunger rapidly opening the contacts), the blowout magnet and the arc chamber, results in an extremely high short-circuit breaking capacity, and very low let through energy.*

Snap-on clip for DIN-type rail mounting
This special flexible system gives ease of mounting and positioning of the MCB on Din rail.

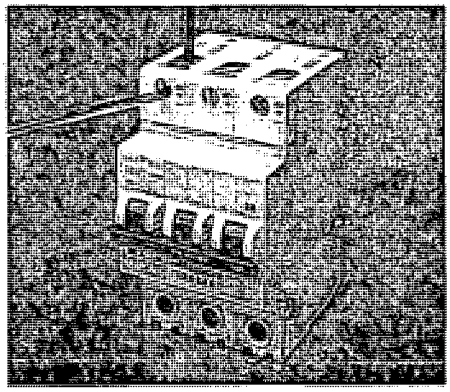
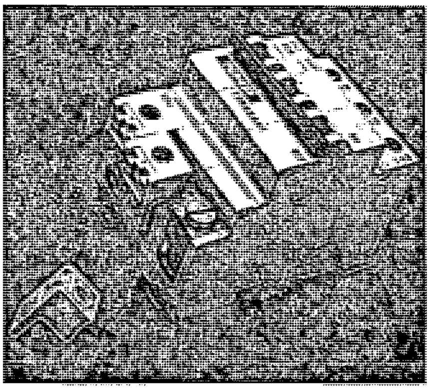
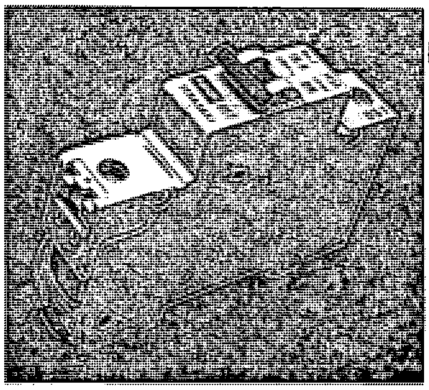
Din - T SERIES —

Some of the advantages in detail

Input terminal

The newly developed input box terminal which is designed as a "Lift terminal" is suitable for busbar as well as conductor connection. It is delivered already opened so that loosening of the terminal screws is not necessary. The screw heads are held in the upper position so that busbars can be located directly and without any problems. However it is first necessary to remove the standard IP-20 protection cap. For the connection of single or multiple-wire conductors the terminal box is moved down by pressing the screw head and is opened approx. 5 mm. This means conductors up to 10 mm² can be inserted without further opening. For thicker conductors up to max. 1 x 35 mm² or 2 x 16 mm² the terminal box needs only to be unscrewed a little. In the same way, a combined connection of busbar and feeding line is possible without additional terminals.

Output terminal

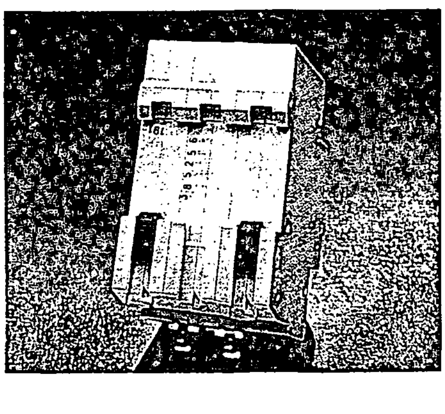
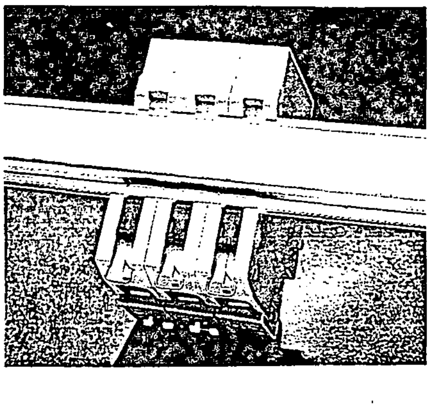
The output terminal is designed as a box terminal with captive terminal screw and is finger and hand safe. The terminal, already opened in the delivery state, receives multiple-wire conductors with cross sections of up to 1 x 25 mm² or 2 x 10 mm².

Protection Cap

Simple snap-on cap for the "Lift terminal" can be fixed on to the MCB in order to obtain the IP-20 protection against finger contact. For the Australian market, these are supplied as standard.

Sealing

In both switching positions the handles can be protected against manual switching by means of sealing. Interruption in case of faults is guaranteed by means of a trip free mechanism.

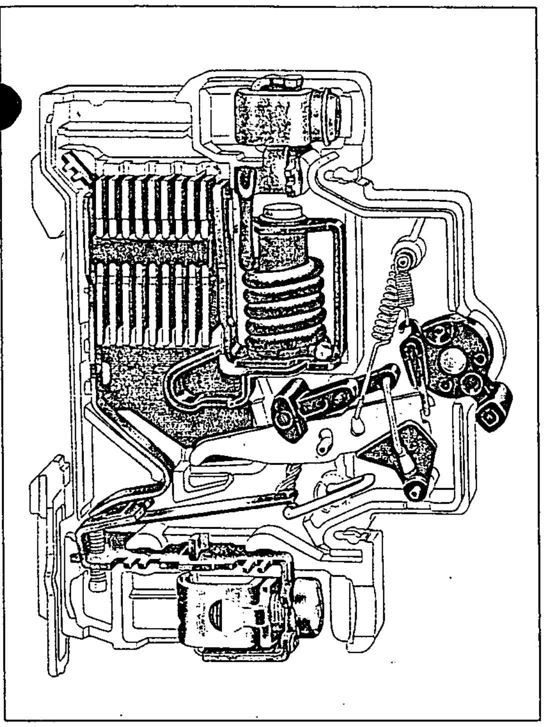



Snap-on fixing

The newly developed snap-on fixing has an additional stop location which permits slight movement and alignment of the MCB during assembly on the rail.
A further advantage is the easy changing of the MCB in this stop location, as the spring device is disengaged when it is taken off the sectional rail.

For fixing of the MCB on the sectional rail the spring device is engaged by simply pressing the projecting spring clip

Din - T SERIES — 6kA



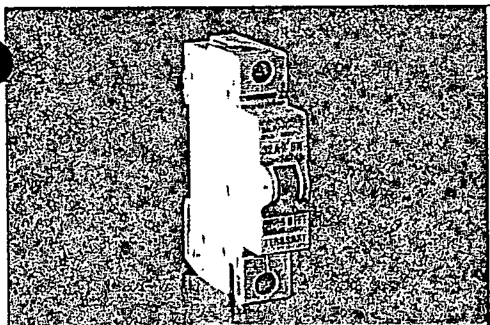
The 6000 Series offers unparalleled choice of DIN rail mounted miniature circuit breakers. This high performance device uses all the latest developments and technology of circuit breaker protection and is capable of dealing with the most difficult problems. These include high short circuit currents and selectivity with a feeder, or back-up protection. The 6000 Series is designed and certified to many International and National Specifications, especially AS3111. Truly an International range of high performance miniature circuit breakers.

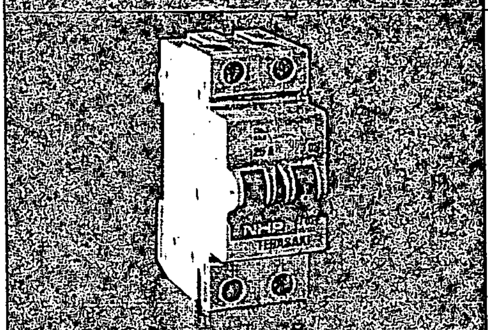
Mounting:
Suitable for quick mounting (snap-on) symmetric DIN rail.

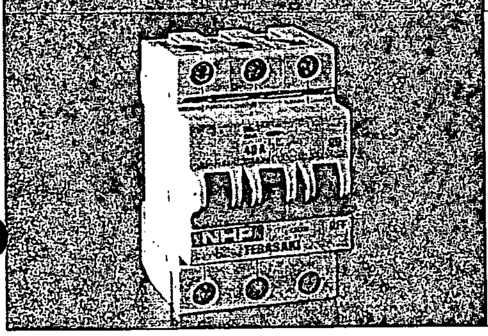
Ratings:
Rated voltages from 240/415 volts A.C. Rated currents from 2 amps to 40 amps. Available in 1 pole, 2 pole and 3 pole.

The 6000 Series is of the highest protection and, as standard with the entire Din-T system, finger protected to IP20.

Ordering Details





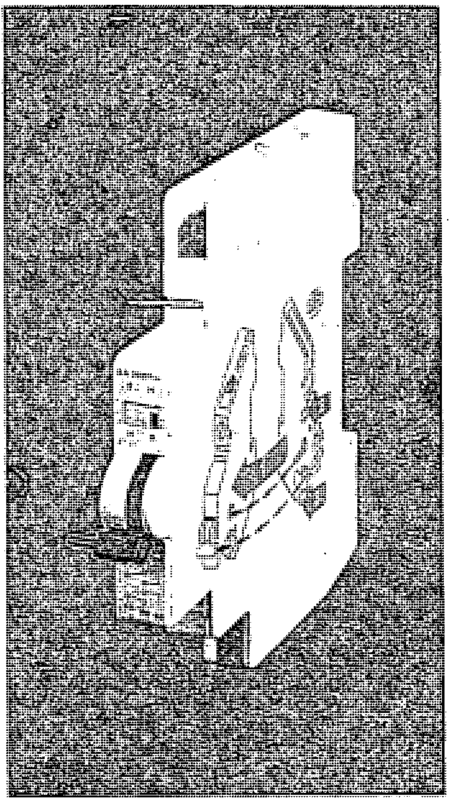


	RATED CURRENT	**6 kA** Interrupting Capacity to AS3111 Part No.	**Price**
Single pole	2	Din-T 6 102	$11.60
	4	Din-T 6 104	$11.60
	6	Din-T 6 106	$11.60
	10	Din-T 6 110	$11.60
	16	Din-T 6 116	$11.60
	20	Din-T 6 120	$11.60
One protected pole	25	Din-T 6 125	$11.60
	32	Din-T 6 132	$11.60
	40	Din-T 6 140	$11.60
Double pole	2	Din-T 6 202	$34.80
	4	Din-T 6 204	$34.80
	6	Din-T 6 206	$34.80
	10	Din-T 6 210	$34.80
	16	Din-T 6 216	$34.80
	20	Din-T 6 220	$34.80
Two protected poles	25	Din-T 6 225	$34.80
	32	Din-T 6 232	$34.80
	40	Din-T 6 240	$34.80
Triple pole	2	Din-T 6 302	$54.80
	4	Din-T 6 304	$54.80
	6	Din-T 6 306	$54.80
	10	Din-T 6 310	$54.80
	16	Din-T 6 316	$54.80
	20	Din-T 6 320	$54.80
Three protected poles	25	Din-T 6 325	$54.80
	32	Din-T 6 332	$54.80
	40	Din-T 6 340	$54.80

Note 1 Din-T MCB's can be backed up by a 125 amp GEC Type-T or equivalent HRC fuse to 50kA fault level.

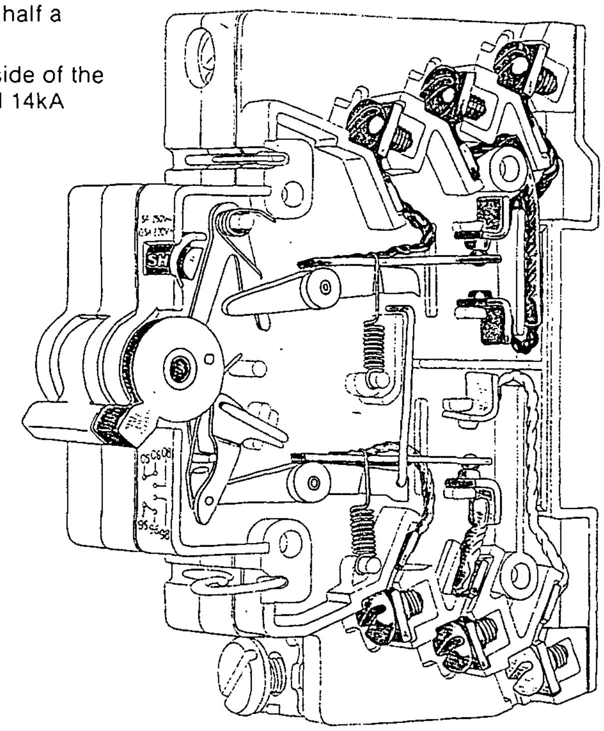
Price Schedule T1

AUXILIARY CONTACTS FOR MCB's



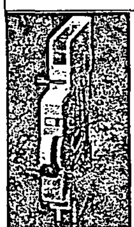
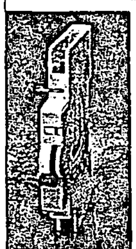
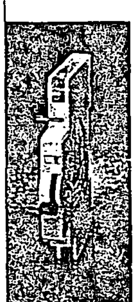
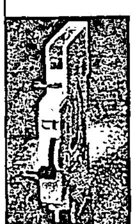
Four variant types in half a module.

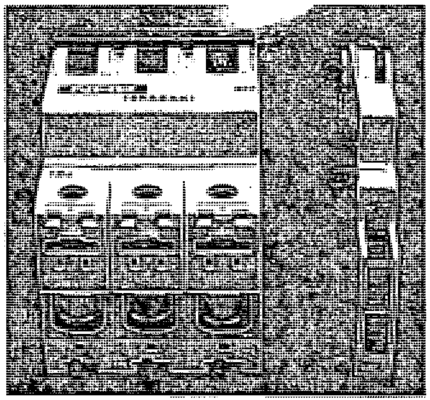
Snap-on right hand side of the MCB's both 9 kA and 14kA models.



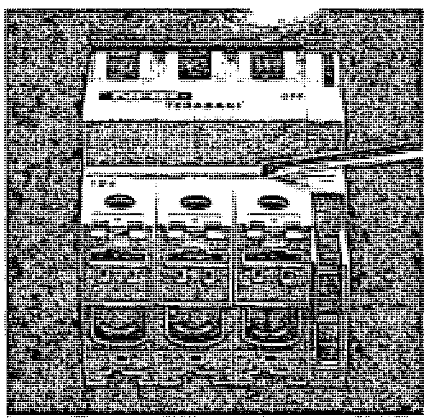
Connection capacity
— 3/6 flat terminals with each max. 2.5 mm².

Din-T H + H/S.

	Part No.	Description	Price
	**Din-T H**	Auxiliary contact (H) only. Half a module (9 mm) with a changeover contact (1NC + 1 NO) Contacts are operated when the MCB is operated manually as well as electrically (i.e. due to overload or short-circuits). Thus this contact indicates the exact position of the contacts of the MCB.	$19.00
	**Din-T S**	Alarm contact (S) only. Half a module (9 mm) with a change over contact (1 NC + 1 NO). Manually operated, this contact only follows the closing movement, not the opening movement. When the MCB had tripped electrically (through overload or short-circuit), the signal follows. Thus this contact indicated manual closing and electrical opening of the MCB.	$25.00
	**Din-T H/S**	Changeable alarm/auxiliary contact (H/S). Half a module with a changeover contact (1 NC + 1 NO). A small screw can be put in two positions (with a screwdriver). Each of the two positions corresponds for this special contact to have the function of an auxiliary or of a signal contact as explained above. A small screen indicates H (auxiliary) or S (signal) function. Once the auxiliary element is coupled to the MCB the little screw is hidden and thus the function can not be changed.	$26.00
	**Din-T H+ H/S**	Auxiliary contact and changeable alarm/ auxiliary (HH/HS). Half a module (9 mm) contains two changeover contacts. The first one is an auxiliary contact (H). The second one is a changeable signal/ auxiliary contact (H/S). For the function of both changeover contacts, see above. *Refer P.15 for explanation of contact types.	$33.00



When coupling an auxiliary element to the side of an MCB both handles must be in identical position.



Bring the MCB and auxiliary function side by side carefully.
Fix together by means of the two specified springs.
Note. When opening the spring again, the auxiliary element can be removed.
Attention: Always open spring on MCB-side.

MCB's — GENERAL FEATURES

Characteristics		1P	2P	3P	4P
No. of protected poles		1	2	3	4
Width	mm	18	36	54	72
Depth	mm	68	68	68	68
Rated voltage (Un)	V	240/415	415	415	415
Highest rated current	A	63	63	63	63
No. of operations - at 220V. In. cos φ = 0.7 - at 415V. in. cos φ = 0.9		 10000 10000	 10000 10000	 10000 10000	 10000 10000
Insulation resistance	M	$> 10^5$	$> 10^5$	$> 10^5$	$> 10^5$
Dielectric rigidity	kV	> 4	> 4	> 4	> 4
Capacity - output terminal - input terminal	 mm^2 mm^2	 25 35	 25 35	 25 35	 25 35
Insulation group according to IEC 112. NBN C20-002. VDE 0110 - group B - group C	 V V	 500 380/415	 500 380/415	 500 380/415	 500 380/415

Use in DC	Max. DC tension	No. of operations at In/time constant T ≦ ms	Short-circuit capacity/time constant T ≦ ms
1P up to 20A	48V	4000/15	10/15
2P up to 20A	110V	4000/15	15/15
1P 25A to 63A	48V	3000/15	10/15
2P 25A to 63A	110V	3000/15	15/15

In DC the magnetic tripping current is approximately 40% higher than in AC 50/60 Hz.

Voltage drop and energy loss

In (A)	Size No.	Drop in voltage (V)	Energy loss (W)
0.5	0.5	3	1.5
1	1	2	2
2	2	1.5	3
4	4	0.6	2.4
6	6	0.4	2.4
10	12	0.13	1.3
16	17	0.16	2.56
20	22	0.15	3
25	28	0.13	3.25
32	35	0.11	3.52
40	42	0.11	4.4
50	52	0.085	4.25
63	65	0.11	6.9

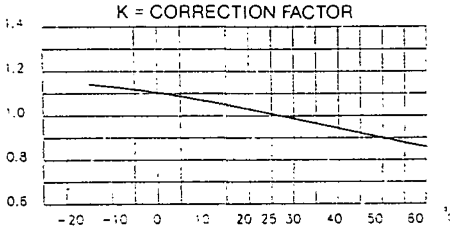
Use at 400 Hz.

At 400 Hz the magnetic tripping current is ± 40% higher than at AC 50/60 Hz.

NHP TERASAKI Din -T

TEMPERATURE DERATING CHART 0.5–4 AMP

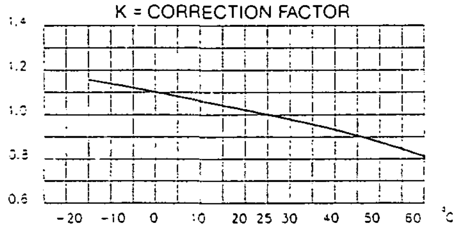
K = CORRECTION FACTOR



NHP TERASAKI Din -T

TEMPERATURE DERATING CHART 6–32 AMP

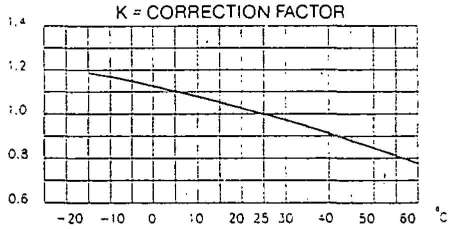
K = CORRECTION FACTOR

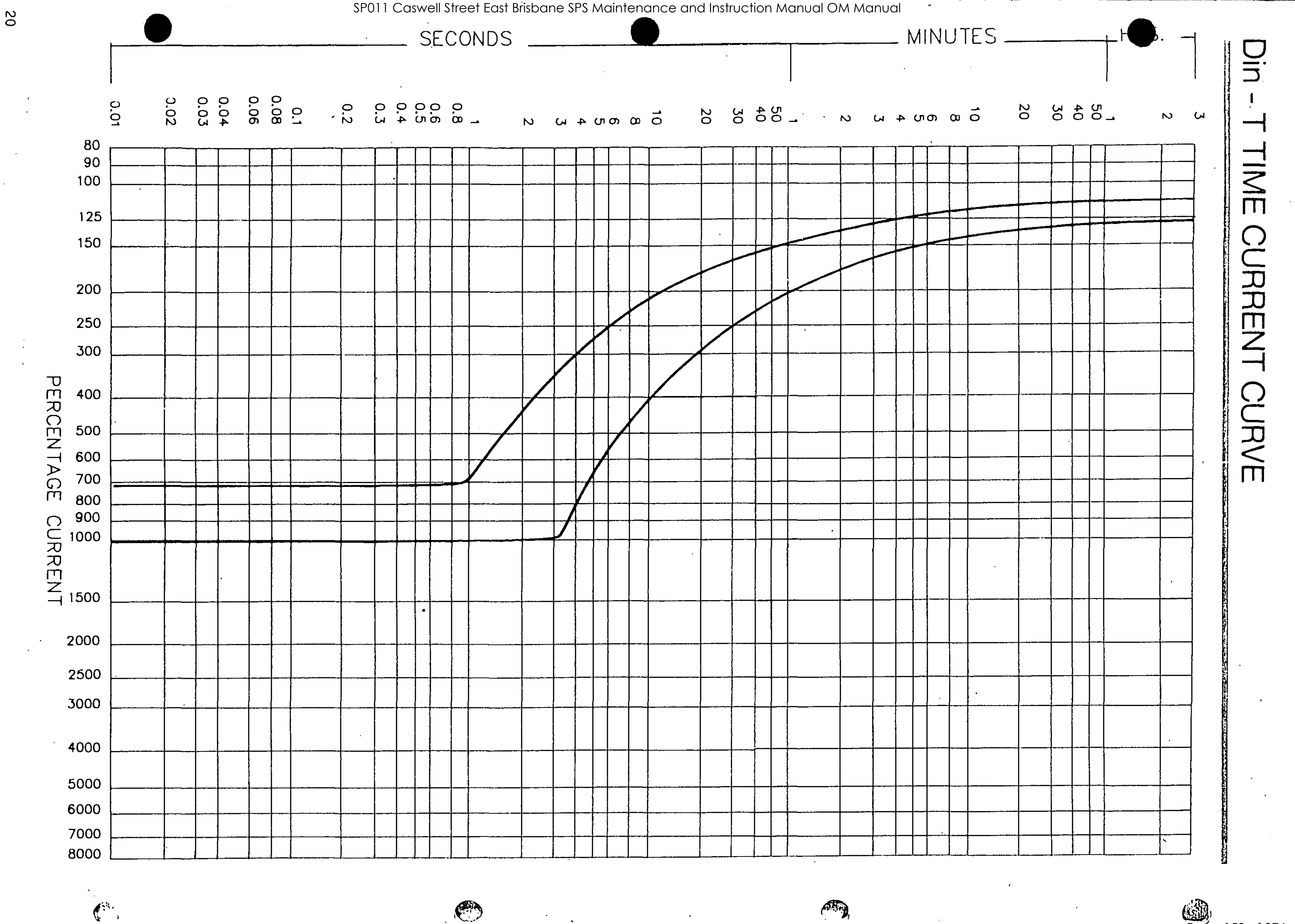


NHP TERASAKI Din -T

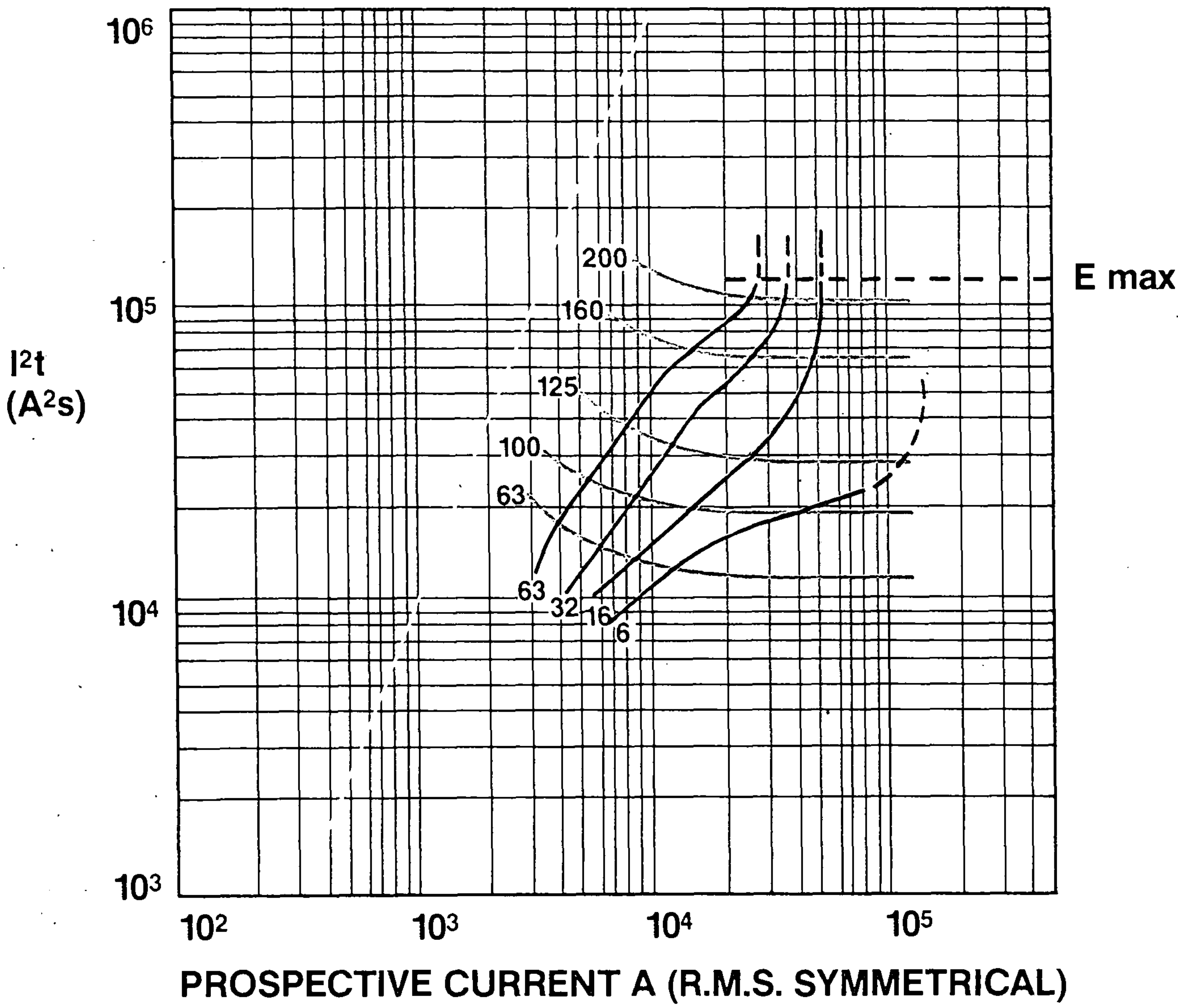
TEMPERATURE DERATING CHART 40–63 AMP

K = CORRECTION FACTOR




20
Din - T TIME CURRENT CURVE
SECONDS
MINUTES
PERCENTAGE CURRENT
80
90
100
125
150
200
250
300
400
500
600
700
800
900
1000
1500
2000
2500
3000
4000
5000
6000
7000
8000

Din - T CO-ORDINATION MCB and FUSES



Co-ordination is achieved between the HRC fuses and Din-T Miniature Circuit Breakers when the I^2t let-through value of the back-up fuse is greater than the I^2t let-through value of the MCB.

To check co-ordination, select a prospective fault level, project it to a selected MCB line (shown by vertical lines) and any fuse line (shown by horizontal curves). Above this projected point will offer back-up protection and co-ordination between fuses and MCB's.

Din - T CO-ORDINATION MCB and FUSES

Selection Chart

MAKE OF EQUIPMENT	CLASS OF GEAR	TYPE OF EQUIPMENT	MAX CONTACT RATING AMPS	LIST NUMBER PREFIX LETTERS & CURRENT RANGE																				
				NS 2-32	ES 40-63	NIT 2-20	TIA 2-32	TIS 35-63	TB 2-63	TBC 2-63	OS 80 & 100	TCP 80 & 100	TL 80 & 100	TF 125-200	TKF 250 & 315	TKM 250 & 315	TMF 355 & 400	TM 355 & 400	TTM 450-630	TLM 670-800	TLT 670-680	TLU 560-800	TXU 1000-1250	TUV 1000-1600
NHP TERASAKI	MCB	DIN-T 9kA	6	20		20	20		20	20				200										
			10	25			25		25	25				200										
			16					35	35	35				200										
			20		63			63	63	63				200										
			25		63			63	63	63				200										
			32		63			63	63	63				200										
			40								100	100	100	200										
		DIN-T 14kA	6	20		20	20		20	20				200										
			10	25			25		25	25				200										
			16					35	35	35				200										
			20		63			63	63	63				200										
			25		63			63	63	63				200										
			32		63			63	63	63				200										
			40								100	100	100	200										
			50								100	100	100	200										
			63								100	100	100	200										

Din-T Cascade Co-ordination Chart

RATED BREAKING CAPACITY / BACK-UP BREAKER			TO 100 BA	TL 225 B	TO 225 BA	TG 225 B	TO 400 BA	TG 400 B
LOAD SIDE BREAKER			22	180	35	50	36	50
DIN-T	.5-16	9kA		130				
	.5-25	9kA			35	50	35	50
	.5-63	9kA			20	25	20	25

Cascade Co-ordination Application Notes

The Back-up or Upstream Terasaki Moulded Case Circuit Breakers are listed across the top line together with their prospective short circuit interrupting capacity.

The Loadside or Downstream Din-T Miniature Circuit Breakers are listed in the left hand vertical column.

The prospective short circuit interrupting capacity of circuit breaker in Cascade can be read from the chart by running down the vertical column under the selected back-up breaker (eg. To 225 BA) and across the horizontal column of any load size circuit breaker (eg. Din-T 9 .5-25).

The figure shown at the intersecting columns is the prospective short circuit interrupting capacity at which the load side miniature circuit breaker will operate safely (eg. 35kA).

Note 1 Cascading is not suitable for special circuits such as fire pumps and lifts.

JK

SECTION J

CURRENT TRANSFORMERS

CROMPTON

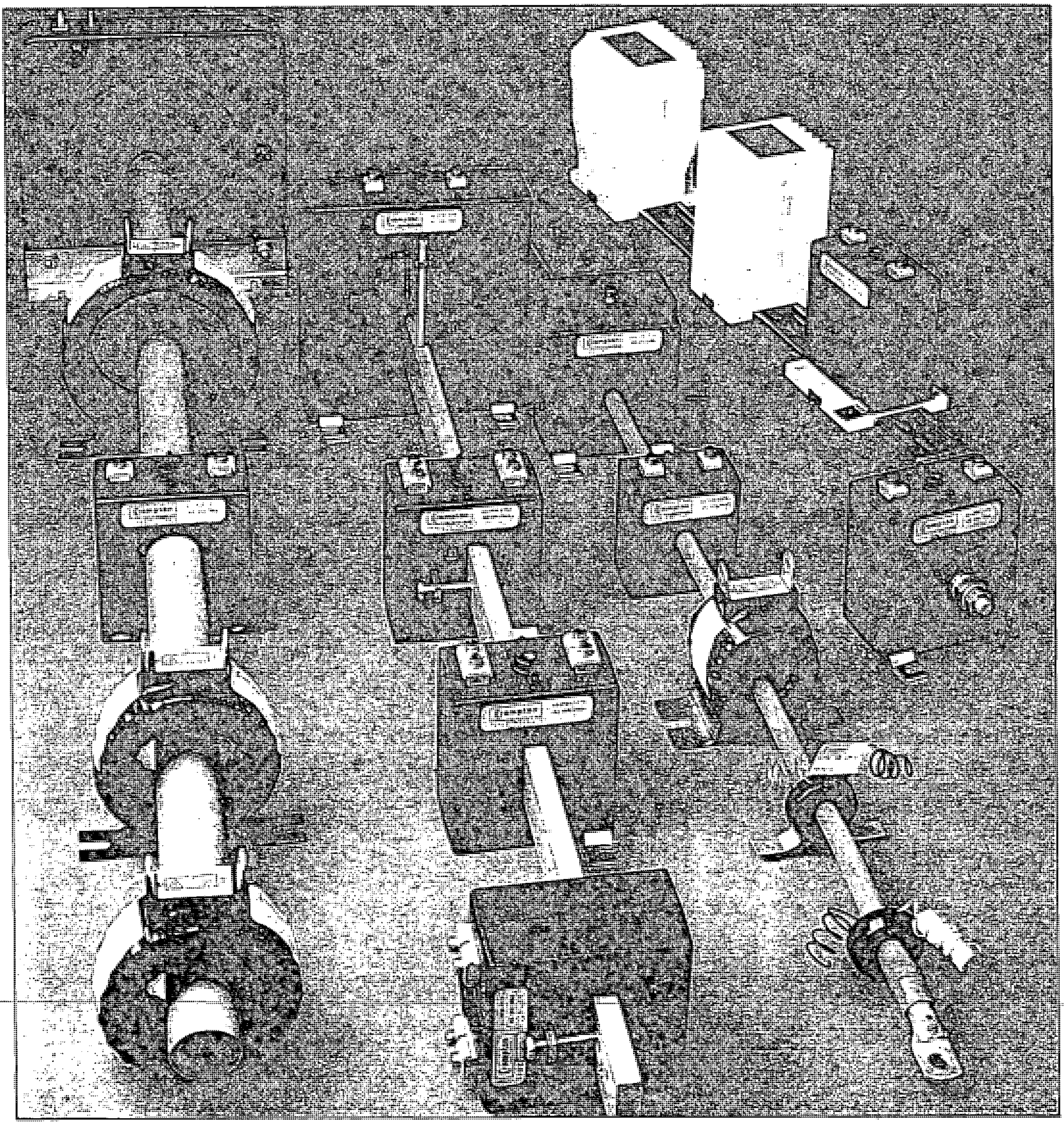
789-944T 400/5 A CURRENT TRANSFORMERS
788-944T 500/5 A CURRENT TRANSFORMERS
781-943T 40/5 CURRENT TRANSFORMER (4 PRIMARY TURNS)

SUPPLIED BY: CROMPTON INDUSTRIES
20 CHATFORD STREET
MACGREGOR QLD 4109
TELEPHONE: (07) 841 1586

CROMPTON

Crompton INSTRUMENTS HAWKER SIDDELEY

CURRENT TRANSFORMERS



SCCT Edition 1

Current Transformers

HAWKER SIDDELEY
Crompton INSTRUMENTS

Contents Guide

Multi-Ratio, Summation, Interposing, Core-Balance and Earth Leakage Current Transformers

These special duty current transformers can be supplied to customers' requirements. Please supply details of primary and secondary current ratios required, VA output and accuracy class.

C.T's with alternative specifications

Customers special requirements can usually be met. Please supply full details.

Low Current Ratios

Lower ratios than those listed can be obtained by passing the primary conductor through the ring more than once as specified below.

STANDARD CT RATIO	PRIMARY INSERTED TURNS TO OBTAIN REQUIRED RATIO								
	5/5	10/5	15/5	20/5	25/5	30/5	40/5	50/5	60/5
40/5	8	4	—	2	—	—	1	—	—
50/5	10	5	—	—	2	—	—	1	—
60/5	12	6	4	3	—	2	—	—	1
75/5	15	—	5	—	3	—	—	—	—
80/5	16	8	—	4	—	—	2	—	—
100/5	20	10	—	5	4	—	—	2	—
120/5	24	12	8	6	—	4	3	—	2

Current Transformers

Hawker Siddeley Crompton Instruments

Measuring Duty Current Transfomers

Accuracy selection

Class 0.2	Available on request. Designed to individual customer requirements, energy metering, micro control systems.
Class 0.5	Transducers, pay integration meters, test equipment, control systems. Watt/VAr/Phase Angle meters,
Class 1	recording meters, protection devices, instrument transducers.
Class 3	Industrial ammeters, maximum demand indicators.

VA Burden Guide

0.5	Short scale moving iron ammeters
0.75—1.5	240° scale moving iron ammeters
0.2—1	Rectified moving coil ammeters
1—1.25	Watt/VAr/Phase Angle meters
2—4	Recording ammeters
2—3.5	Maximum Demand Indicators
3—3.5	Combined MDI & MI
0.5—4	Paladin transducers
0.5—4	Protector modules
5—10	Electronic control systems

Protection Duty Current Transformers

Protection duty current transformers are supplied to accuracy classes 5P or 10P. The figures 5 or 10 define the maximum composite errors in percentage permitted at the specified overload value. Letter 'P' indicates a protection duty.

The rated accuracy limit factor (or overload multiple) is specified by a further figure added to the code. 5, 10 and 15 satisfy most applications and indicate overload values x5, x10 and x15. For more detailed information, see BS3938: 1973.

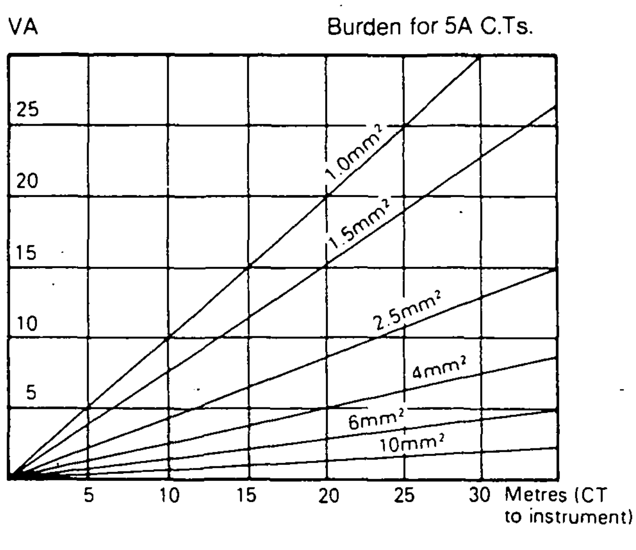
Rated outputs available in VA are 2.5, 5, 7.5, 10, 15. Correct selection requires reference to relay manufacturers recommendations.

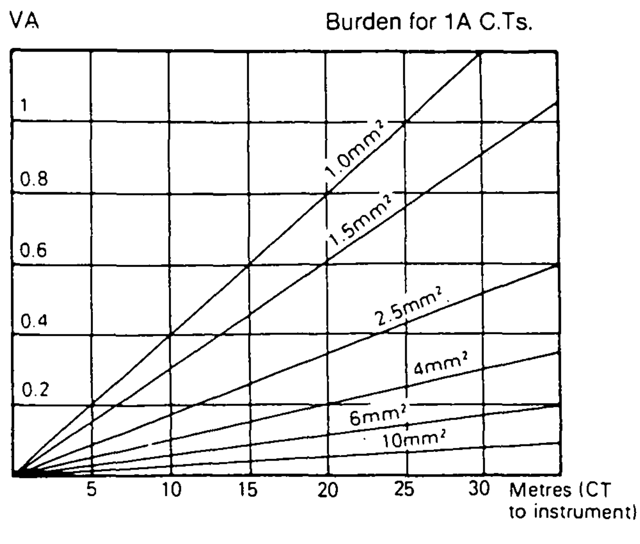
Limits of error to BS3938: 1973				
Accuracy Class	Error at rated Primary Current	Phase displacement at rated Primary Current Mins	Radians	Composite error at rated accuracy limit Primary current
5P	±1%	±60	±1.8	5%
10P	±3%	—	—	10%

The secondary circuit must not be open-circuited when primary is energised since a dangerously high voltage can build up in certain conditions. Terminals are not insulated against physical contact.

Secondary Lead Burden

The resistance of the secondary lead circuit can be significant and must be taken into account when the current transformer burden is chosen. Where the current transformer is mounted remotely a 1 amp secondary should be used.

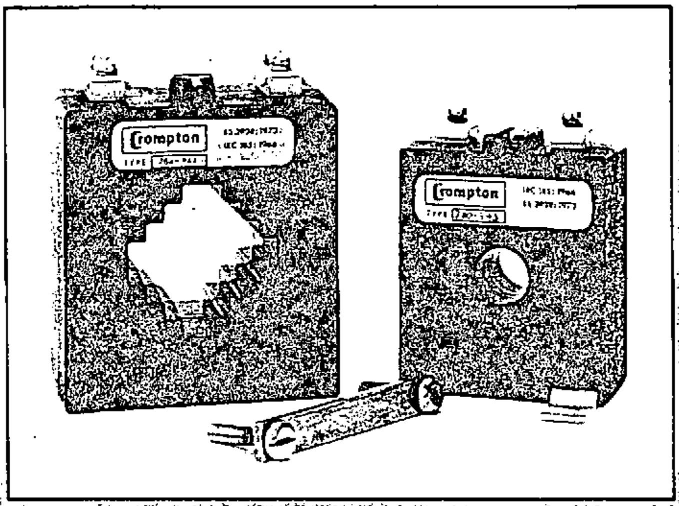




780 Series

Crompton INSTRUMENTS HAWKER SIDDELEY

The Crompton 780 Series offers current ratios, VA outputs and accuracy classes to suit the requirements of modern electrical and electronic installations.
The tough moulded cases are designed for appropriate busbar or cable sizes and incorporate alternative foot or busbar fixing options.
They comply with most international standards for ring current transformers.
A major feature is the ease of installation with several base and busbar mounting arrangements.



Features

- ★ high impact, flame-retardant moulded cases (classification UL94V-1)
- ★ secondary currents for 1A or 5A
- ★ primary currents 1A to 2500A
- ★ cable or busbar styles
- ★ simple busbar clamp or push-in fixing feet
- ★ alternative DIN rail mounting adaptor
- ★ single or twin screw terminals
- ★ alternative terminations with integral 600mm leads
- ★ wire sealable terminal cover

Standards Compliance

Designed to international standards, the 780 Series complies with the following specifications BS3938: 1973 (1982), IEC 185: 1966

Secondary Terminals

All models can be supplied with single or double M4 screw shell clamp terminals eliminating the use of cable shoes or tags.
When specified insulated flexible leads (600mm) can be provided in place of screw terminals.

Performance

System voltage	=	660V max
Test voltage	=	3kV for 1m
System frequency	=	50/60Hz (400Hz available on request)
Short circuit thermal current (Ith)	=	60 x rated primary current for 1 second
Rated dynamic current (Idyn)	=	2.55 x Ith
Saturation co-efficient	=	<5 for plain ring <10 for wound primary
Service temperature	:	−20°C to 85°C
Insulation class BS2757	:	Class A (max 105°C)
Enclosure code	:	IP40

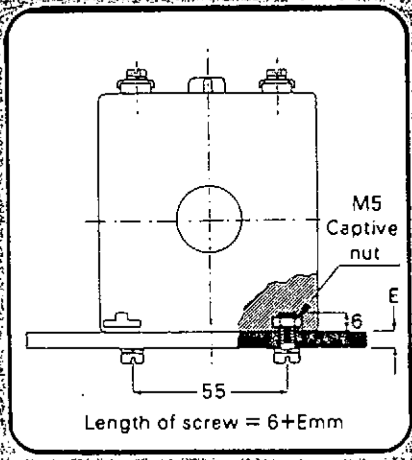
Installation

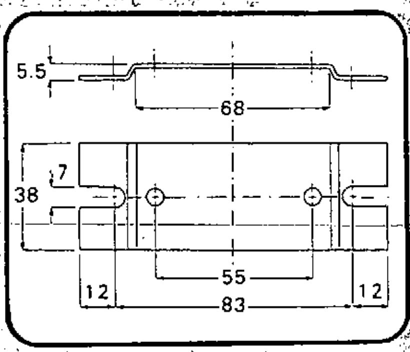
A set of push-in fixing feet or busbar clamp, as necessary, are supplied with each CT.

In-line primary busbar inserts and centre insert are available for some models.

A 35mm DIN rail mounting adaptor is available for all models except 788.

Models 781, 782, 783, 784, 785, 786 have two M5 screw fixings in the base.



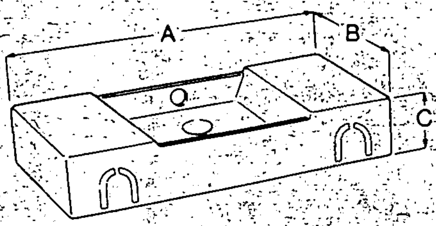


780 Series

Crompton Instruments — Hawker Siddeley

Terminal cover

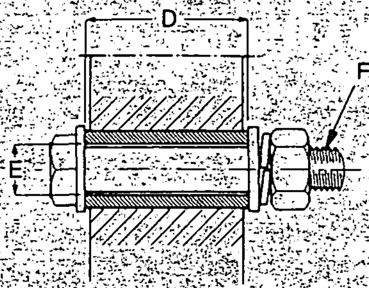
A wire sealable cover is available to insulate the secondary terminals.



Type No.	DIMENSIONS mm A	B	C
780	56	31	14
All other Types	71	38	14

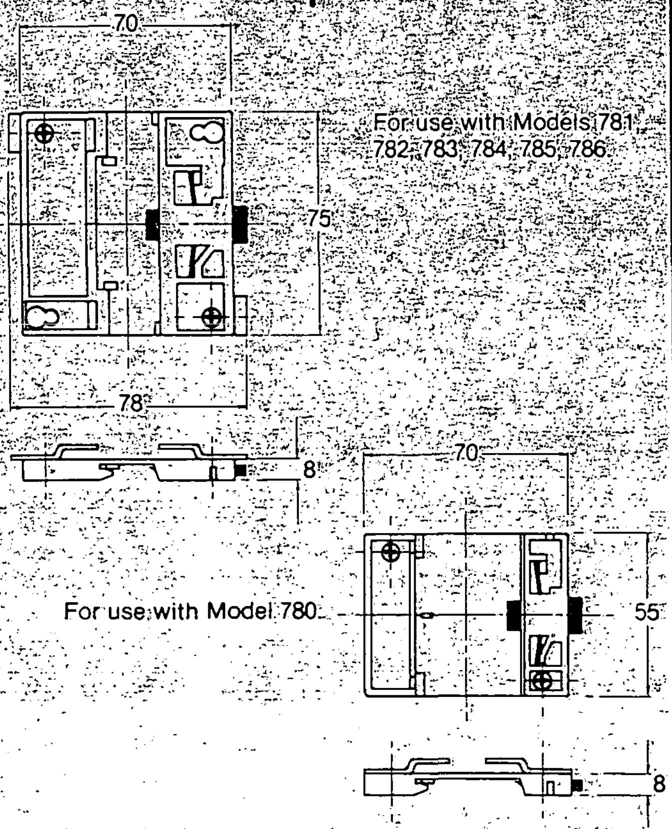
Fixing between 2 conductors

A centre insert, designed for types 780 and 781 allows clamping between two bar or cable primary conductors.

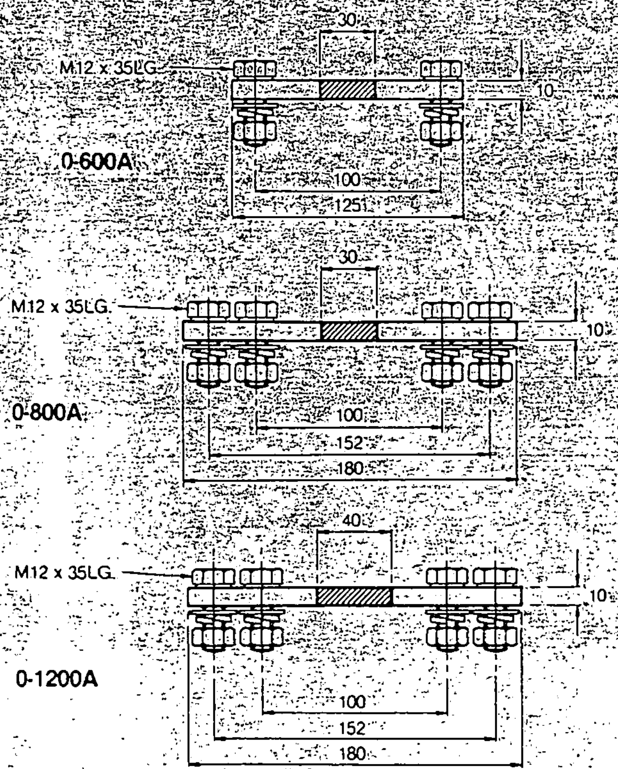


Type No.	DIMENSIONS mm D	E	F
780	36	8.2	M8x50
781	46	14	M12x75

DIN Rail Adaptor



Primary Busbars



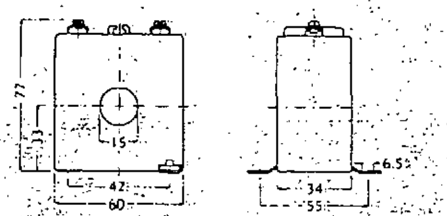
780 Series

HAWKER SIDDELEY
Crompton INSTRUMENTS

Accuracies comply with BS3938: and IEC 185:

All measurements in millimetres

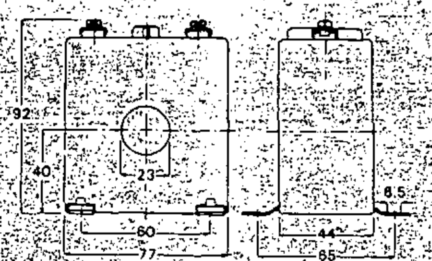
Type 780—943



Supplied with 2 fixing feet.
Max cable Ø = 15mm.
1A secondaries are available for all ratings.

CT Ratio	VA at Class 5	3	1
30/5	1.5	—	—
40/5	2	1.5	—
50/5	2.8	2.5	—
60/5	3.5	3	—
75/5	5	4	—
80/5	5	4	—
100/5	—	5	2.5
120/5	—	5	2.5
125/5	—	5	2.5
150/5	—	5	2.5
200/5	—	6	3
250/5	—	7.5	4

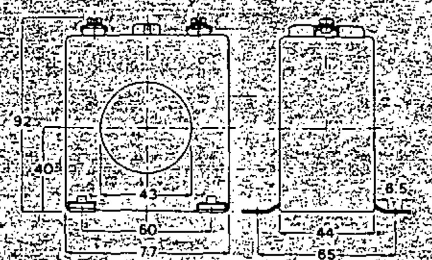
Type 781—943



Supplied with 4 fixing feet.
Max cable Ø = 23mm.
1A secondaries are available for all ratings.

CT Ratio	VA at Class 3	1	VA at Class 3	1	VA at Class 3	1	0.5
40/5	2.5	—	—	—	—	—	—
50/5	2.5	—	—	—	—	—	—
60/5	2.5	—	—	—	—	—	—
75/5	2.5	—	5	2.5	—	—	—
80/5	2.5	—	5	2.5	—	—	—
100/5	5	—	7.5	5	—	—	—
120/5	5	—	7.5	5	—	—	—
125/5	5	—	7.5	5	—	—	—
150/5	5	—	7.5	5	15	10	5
200/5	5	—	7.5	5	15	10	7.5
250/5	5	2.5	7.5	5	20	15	10
300/5	5	2.5	7.5	5	20	15	10
400/5	5	2.5	10	5	30	15	15
500/5	5	2.5	10	5	30	15	15

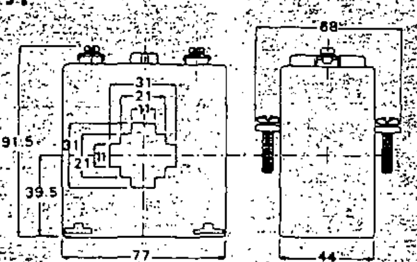
Type 782—943



Supplied with 4 fixing feet.
Max cable Ø = 43mm.
1A secondaries are available for all ratings except 1200A.

CT Ratio	VA at Class 3	VA at Class 3	1	VA at Class 3	1	0.5
100/5	2.5	—	—	—	—	—
120/5	2.5	5	2.5	—	—	—
125/5	2.5	5	2.5	—	—	—
150/5	2.5	7.5	4.5	—	5 or	3
200/5	2.5	7.5	5	10	6	2.5
250/5	5	7.5	5	10	7.5	5
300/5	5	7.5	5	10	7.5	5
400/5	5	7.5	5	15	7.5	5
500/5	—	—	—	10	7.5	5
600/5	—	—	—	12	10	7.5
750/5	—	—	—	15	10	10
800/5	—	—	—	15	10	10
1000/5	—	—	—	20	15	15
1200/5	—	—	—	20	15	15

Type 783—944



Supplied with busbar clamp
For busbar 30 x 10, 20 x 20mm and cable Ø 25mm.
1A secondaries are available for all ratings.

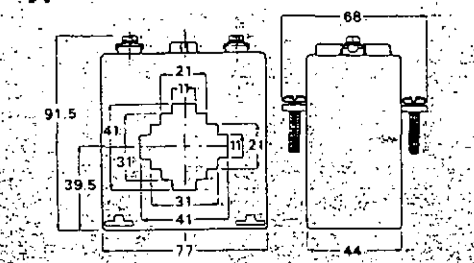
CT Ratio	VA at Class 3	1	VA at Class 3	1	VA at Class 3	1	0.5
75/5	2.5	—	—	—	—	—	—
80/5	2.5	—	—	—	—	—	—
100/5	2.5	—	5	2.5	—	—	—
120/5	2.5	—	5	5	—	—	—
125/5	2.5	—	5	5	—	—	—
150/5	2.5	—	5	5	10	7.5	2.5
200/5	5	—	7.5	5	15	10	5
250/5	5	2.5	10	7.5	20	15	10
300/5	5	2.5	15	10	20	15	10
400/5	5	2.5	15	10	20	15	10
500/5	—	—	—	—	30	15	10
600/5	—	—	—	—	30	15	15
750/5	—	—	—	—	30	15	15
800/5	—	—	—	—	30	15	15

780 Series

Crompton INSTRUMENTS HAWKER SIDDELEY

Accuracies comply with BS3938: and IEC 185:

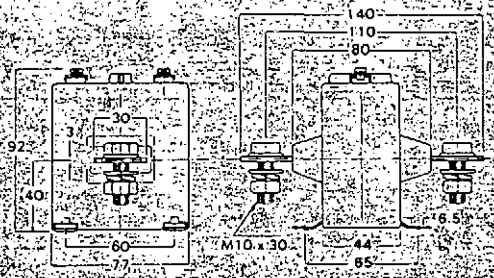
Type 784—944



Supplied with busbar clamp.
For busbar 40 x 10, 30 x 20mm and cable Ø 32mm.
1A secondaries are available for all ratings except 1200A

CT Ratio	VA at Class 3	VA at Class 3	VA at Class 1	VA at Class 3	VA at Class 1	VA at Class 0.5
100/5	2.5	—	—	—	—	—
120/5	2.5	5	2.5	—	—	—
125/5	2.5	5	2.5	—	—	—
150/5	2.5	6	4.5	6	4.5	2.5
200/5	2.5	7.5	5	10	6	2.5
250/5	5	7.5	5	10	7.5	5
300/5	5	7.5	5	10	7.5	5
400/5	5	7.5	5	15	7.5	5
500/5	—	—	—	10	7.5	5
600/5	—	—	—	12	10	7.5
750/5	—	—	—	15	10	10
800/5	—	—	—	15	10	10
1000/5	—	—	—	20	15	15
1200/5	—	—	—	20	15	15

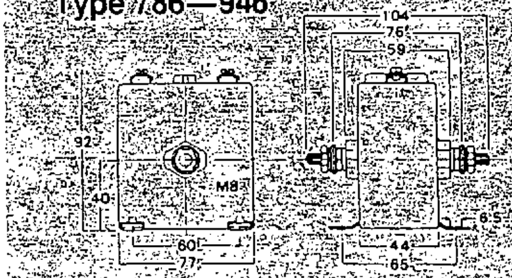
Type 785—946



Supplied with 4 fixing feet.
1A secondaries are available for all ratings.

CT Ratio	VA at Class 3	VA at Class 3	VA at Class 1	VA at Class 3	VA at Class 1	VA at Class 0.5
1/5	5	7.5	5	18	15	7.5
5/5	5	7.5	5	18	15	7.5
7.5/5	5	7.5	5	18	15	7.5
10/5	5	7.5	5	18	15	7.5
15/5	5	7.5	5	18	15	7.5
20/5	5	7.5	5	18	15	7.5
25/5	5	7.5	5	18	15	10
30/5	5	7.5	5	18	15	10
40/5	5	7.5	5	18	15	10
50/5	5	7.5	5	18	15	10
60/5	5	7.5	5	15	15	10
75/5	5	7.5	5	18	15	10
80/5	5	7.5	5	18	15	10
100/5	5	7.5	5	18	15	10
120/5	5	7.5	5	20	15	10
125/5	5	7.5	5	20	15	10
150/5	5	7.5	5	20	15	10
200/5	5	7.5	5	20	15	10
250/5	5	7.5	5	20	15	10

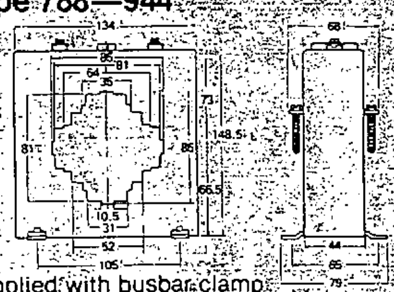
Type 786—946



Supplied with 4 fixing feet.
1A secondaries are available for all ratings.

CT Ratio	VA at Class 3	VA at Class 3	VA at Class 1	VA at Class 3	VA at Class 1	VA at Class 0.5
1/5	5	7.5	5	18	15	7.5
5/5	5	7.5	5	18	15	7.5
7.5/5	5	7.5	5	18	15	7.5
10/5	5	7.5	5	18	15	7.5
15/5	5	7.5	5	18	15	7.5
20/5	5	7.5	5	18	15	7.5
25/5	5	7.5	5	18	15	10
30/5	5	7.5	5	18	15	10
40/5	5	7.5	5	18	15	10
50/5	5	7.5	5	18	15	10

Type 788—944



Supplied with busbar clamp.
4 fixing feet are an optional extra.
For busbar 80 x 30, 64 x 35, 50 x 50mm and cable Ø 63mm.
1A secondaries are available for all ratings except 2500A.

CT Ratio	VA at Class 3	VA at Class 1	VA at Class 0.5	VA at Class 3	VA at Class 1	VA at Class 0.5	10P10 VA
200/5	7.5	2.5	—	10	5	—	—
250/5	10	5	—	15	10	5	—
300/5	15	10	5	20	15	10	—
400/5	15	10	7.5	25	15	10	—
500/5	20	15	10	30	20	15	5
600/5	15	10	5	30	20	15	5
750/5	15	10	5	40	25	15	5
800/5	20	15	7.5	40	30	20	5
1000/5	25	20	10	50	40	30	5
1200/5	30	20	15	50	40	30	5
1500/5	30	20	15	50	40	30	5
1600/5	40	30	20	—	—	—	5
2000/5	50	40	30	—	—	—	5
2500/5	50	40	30	—	—	—	—

SECTION K

CONTACTORS

SPRECHER & SCHUH CA1 & CA3 SERIES

CA3-9-10 110V AC CONTACTOR WITH CT3-12 O/LOAD UNIT
CA1-480 110C AC CONTACTOR

SUPPLIED BY: NHP PTY LTD
25 TURBO DRIVE
COORPAROO QLD 4151
TELEPHONE (07) 891 6008
FAX (07) 891 6139

1

Quick ordering reference

For contactors up to CA 6-105 & accessories

Contactor Type	CA 4-5	CA 4-9	CA 3-9	CA 3-12	CA 3-16	CA 3-23	CA 3-30
Main Poles	3	3	3	3	3	3	3
Auxiliary Contacts	10 or 01	10 or 01	10 or 01	10 or 01	10 or 01	10 or 01	10 or 01
Price $	$52.00	$55.00	$61.00	$72.00	$94.00	$140.00	$188.00
Max. rated voltage	500 volts		660 volts				
AC 1 distribution circuits [4])							
40 deg. C [60 deg. C] amps	20 [16]	20 [16]	25 [16]	25 [16]	25 [16]	45 [30]	45 [30]
Motor starting ratings							
AC 2, AC 3 60 deg. C amps	4.8	8.2	8	11	14	21	28
kW	2.2	4	4	5.5	7.5	11	15
Inching/plugging motors							
AC 4 60 deg. C amps	4.8	8.2	8	11	14	21	28
kW	2.2	4	4	5.5	7.5	10	15

Auxiliary contact block	2 & 4 Pole		1 Pole		2 Pole	
Cat. No. - Price $	Cat. No.	Price $	Cat. No.	Price $	Cat. No.	Price $
	CA 4-P-02	16.80	CA 3-P-H10	11.00	CA 3-P-02	18.00
	CA 4-P-11	16.80	CA 3-P-01	11.00	CA 3-P-11	18.00
	CA 4-P-22	25.50	CA 3-P-L01	11.00	CA 3-P-S11	18.00
	CS 4-P-20	16.80	(late break)		CA 3-P-GE	30.00
	CS 4-P-11	16.80	CA 3-P-S10	11.00	side mount	
	CS 4-P-40	25.50	CA 3-P-S01	11.00	convertible	

Any of the above auxiliary contact blocks can be used with CA 3-9 to CA 3-72N contactors

Auxiliary contacts std/max.	1/5	1/5	1/5 [3])	1/5 [3])	1/5 [3])	1/6 [3])	1/6 [3])

Thermal overload relays							
Overload type	CT 4		CT 3K-12 [1])		CT 3K-17	CT 3-23	CT 3-32
Price $	$60.00		$64.00		$68.00	$90.00	$115.00
Current ranges amps	0.10-0.15	1.8-2.7	0.10-0.15	1.8-2.7	12.5-17.5	16-23	23-32
	0.15-0.23	2.7-4.0	0.15-0.23	2.7-4.0			
	0.23-0.35	4.0-6.0	0.23-0.35	4.0-6.0			
	0.35-0.55	6.0-7.7	0.35-0.55	6.0-9.0			
	0.55-0.80	7.5-9.0	0.55-0.88				
	1.20-1.80		1.20-1.80				
Thermal overloads for use with contactors listed above	CT 4		CT 3K-12		CT 3K-12	CT 3-12	CT 3-12
			CT 3-12		CT 3-12	CT 3-17	CT 3-17
					CT 3K-17	CT 3-23	CT 3-23
					CT 3-17		CT 3-32

Notes: [1]) CT 3K-12/17 are manual reset only. For automatic reset use CT 3-12/17. Refer page 1 - 9.
[2]) Late break - to be used with DC coil.
[3]) Can be increased by using CA 3-P-GE side mounting auxiliary contact block.

Price Schedule 'AA'

Refer catalogue 2202 & 2210

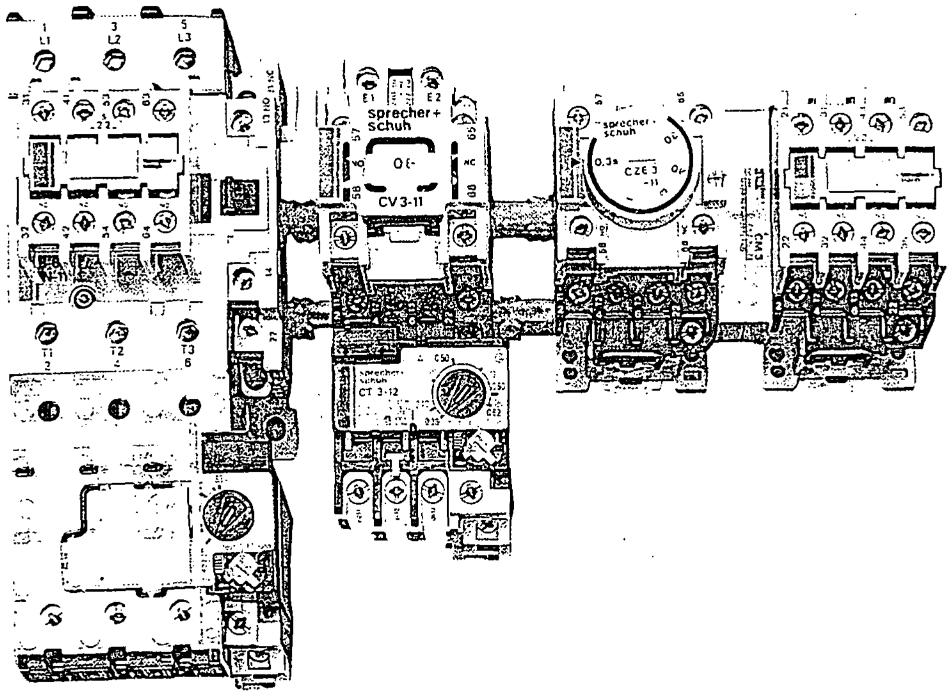
Standard modular contactors 4 to 37kW

Quality, design and reliability

Sprecher + Schuh quality and design is renowned throughout the world in applications where contactors and motor starters are used. The Sprecher + Schuh standard range of contactors provide complete reliability and long life, not equalled by most. The success of these products in Australia and elsewhere has been extraordinary, providing the user with a reliable product for all conditions.

Swiss precision and excellent design are the basis for the success of these products. Not only are the contactors dependable but they are supported by a range of thermal overload relays that offer outstanding motor protection under all conditions. Each thermal overload relay is individually calibrated at manufacture and thus provides a consistency of performance which is not matched by competitors.

The Sprecher + Schuh equipment is compact providing an extensive range of auxiliary contacts, many options and accessories resulting in flexibility and versatility.



The range

Sprecher + Schuh offer a range of contactors totalling 24 different sizes which are designed to match standard motors giving the customer an optimum choice. The smallest units comprise the CA 4 range, designed for OEM use and are suitable for interfacing with PLC's. The specification provides for very low pull-in and holding currents and high frequency of operation.

The CA 3 programme illustrated above, is the most used range and provides 9 sizes from 4 to 37kW. For ratings above 37kW, Sprecher + Schuh provide further sizes up to 710kW.

When you specify Sprecher + Schuh you get additional quality at minimal extra cost. This quality results in reliability, as after all, there is no substitute for reliability!

Sprecher + Schuh provide that extra quality which means so much in service!

Features of the CA 3 contactor

- Rated to 60°C.
- Very compact.
- Mechanical life 10-15 million operations.
- Coil replacement in seconds from the front and without tools.
- Can be mounted:
  On conventional base plates
  On S+S rapid mounting gear tray
  On DIN 35mm snap-on rail up to CA 3-30.
- Identification labelling:
  - Self adhesive labels
  - Strip labels with clear covers
  - S+S marking tags.
- Open type terminals.
- Captive pozi-drive screws.
- Self-lifting terminal washers.
- Tropic-proof coils are standard.
- Provision for snap-on auxiliary contact blocks.
- Provision for snap-on pneumatic time delay relay.
- Provision for snap-on mechanical latch.
- Compatible dimensions:
  - CA 3-12/16 similar size
  - CA 3-23/30 similar size
  - CA 3-37N/72N similar size.
- Guaranteed voltage pick-up.
- High operating frequency.
- Control voltages 50Hz between 12V and 440V.
- Complies with AS 1029, IEC 947 and 587 SEV, VDE, IEC 158.

sprecher + schuh

AC contactors
3 pole - open type

Refer catalogue 2202 & 2210 & CA6-P

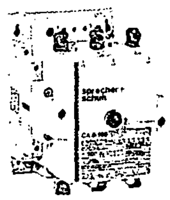
AC 3 Ratings at 60°C
(CA1-480 and above at 50°C)

Ratings to AS 1029 415V, complies with IEC 947

Contactor CA 3-16

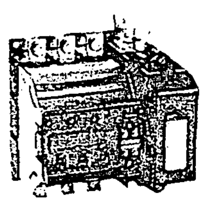
Contactor CA 3-30

Contactor CA 3-72N

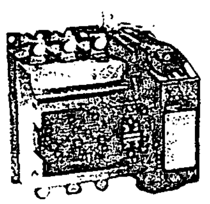


Contactor CA 6-105

Contactor CA 6-170-E



Contactor CA 1-250

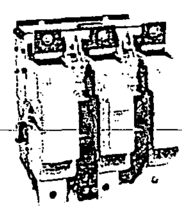


Contactor CA 1-480

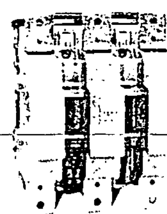
Price Schedule
up to CA 1-480-'AA'
CA 5-370 and up-'A2'

AC 1 Amps 40°C	AC 1 Amps 60°C Encl.	AC 2 AC 3 Amps [2]	AC 2 AC 3 Approx. kW [2]	Auxiliary contacts [4] standard N/O	N/C	Max. [5]	Cat. No.	With std. coil Price $ [3]
25	16	8	4	1	0	5 (9)	CA 3-9-10	61.00
				0	1	5 (9)	CA 3-9-01	61.00
25	16	11	5.5	1	0	5 (9)	CA 3-12-10	72.00
				0	1	5 (9)	CA 3-12-01	72.00
25	16	14	7.5	1	0	5 (9)	CA 3-16-10	94.00
				0	1	5 (9)	CA 3-16-01	94.00
45	30	21	11	1	0	6 (10)	CA 3-23-10	140.00
				0	1	6 (10)	CA 3-23-01	140.00
45	30	28	15	1	0	6 (10)	CA 3-30-10	188.00
				0	1	6 (10)	CA 3-30-01	188.00
63	45	37	20	1	1	7 (11)	CA 3-37N-11	215.00
63	45	40	22	1	1	7 (11)	CA 3-43N-11	225.00
90	75	60	33	1	1	7 (11)	CA 3-60N-11	350.00
90	75	66	37	1	1	7 (11)	CA 3-72N-11	420.00
160	120	90 (33)	50 (45)	1	1	8	CA 6-85-11 [2]	515.00
160	120	90 (33)	50 (45)	1	1	8	CA 6-85-E-11 [2] [6]	610.00
160	120	110 (40)	63 (55)	1	1	8	CA 6-105-11 [2]	605.00
160	120	110 (40)	63 (55)	1	1	8	CA 6-105-E-11 [2] [6]	700.00
250	210	140 (55)	81 (75)	1	1	8	CA 6-140-E-11 [2] [6]	785.00
250	210	170 (65)	98 (90)	1	1	8	CA 6-170-E-11 [2] [6]	895.00
180	125	110	63	1	1	6	CA 1-60	680.00
200	140	135	75	1	1	6	CA 1-100	835.00
240	180	170	95	1	1	8	CA 1-150	955.00
300	250	250	150	1	1	8	CA 1-250	1570.00
500	480	480	300	1	1	8	CA 1-480 [1]	2950.00
500	420	370 (140)	190 (185)	2	2	8	CA 5-370 [1] [2]	1820.00
600	510	450 (200)	255 (280)	2	2	8	CA 5-450 [1] [2]	2050.00
760	645	550 (250)	315 (355)	2	2	8	CA 5-550 [1] [2]	2980.00
900	760	700 (340)	400 (500)	2	2	8	CA 5-700 [1] [2]	3750.00
1100	930	860 (380)	500 (550)	2	2	8	CA 5-860 [1] [2]	6980.00
1200	1080	1000	600	1	1	8	CA 5-1000 [1]	10950.00
1350	1250	1200	710	1	1	8	CA 5-1200 [1]	11500.00

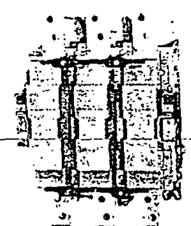
Notes: [1] 55°C enclosed.
[2] 1000 volt ratings ( ).
[3] Price with standard coil.
[4] Auxiliary contacts for CA 1-60 to CA 1-480 are convertible N/O, N/C.
[5] Figures in brackets are max. auxiliary contacts with 2 x side mount auxiliary fitted.
[6] With electronically controlled mechanism (ECM). Available early 1994 for CA 6-85/105.
Please specify coil voltage: Std. 24,32,110,240,415,440V 50Hz CA 1-480 & above min. volt. 32V.
ECM versions coil voltage: 24, 110, 240V 50/60Hz



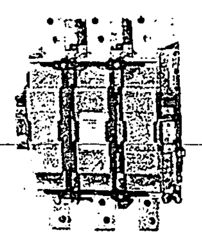
Contactor CA 5-550



Contactor CA 5-860



Contactor CA 5-1000



Contactor CA 5-1200

sprecher + schuh

AC control relays
Type CS 3

Refer catalogue 2202

Heavy duty - 660V

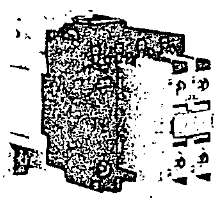
Features:

- Reliable operation in any desired position
- Operationally reliable under vibration and shock conditions, suitable for use in vehicles and ships
- Unaffected by climate, encapsulated standard design under tropical conditions
- Unaffected by pollution, suitably encapsulated
- On and off switching operation in one movement (tumbler characteristics)
- High in-rush current permissible due to bounce-free contact system and high contact pressure
- High permissible operating frequency

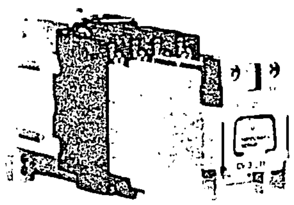
Technical data

Rated thermal current (AC 1) main contacts	60°C	16A
Auxiliary contacts Ith	60°C	12A
Ambient temperature	-20°C to +70°C	
Max. permissible operations per hour	6000	
Coil consumption basic relay 4 pole	Pick-up 59 VA	Hold in 7.2 VA 2.2 W
Mechanical life	15 million operations	

Nominal voltage		V	240	415
Thermal rated current		A	16	16
open and AC 1 (3 phase)		kW	6.7	11.5
Switching, contactor (AC 15)		A	10	4
Auxiliary contact block		A	5.5	2.5
Life	@415 V mill ops		1.2	(AC 15)



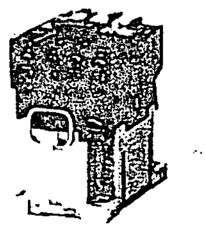
CS 3 Relay with 2 pole auxiliary block



CS 3 Relay with snap-on mechanical latch

8

Complete relays (Additional types) **5 & 8 pole** refer next page for standard arrangements.



CS 3 Basic relay

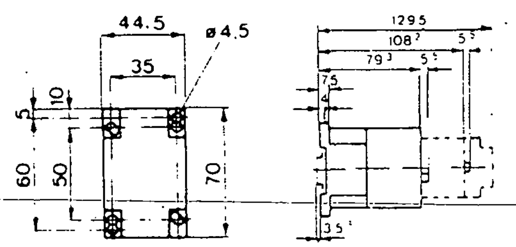
No. of poles	Contacts on relay N/O	N/C	Contacts on aux. contact block N/O	N/C	Total contact arrang. N/O	N/C	Type	Cat. No.	With std. coil Price $
5	4	-	1	-	5	-	Relay with	**CS 3-50**	77.00
	4	-	-	1	4	1	1 pole aux.	**CS 3-41**	
	3	1	-	1	3	2	contact	**CS 3-32**	
	2	2	-	1	2	3	block	**CS 3-23**	
8	3	1	-	4	3	5	with 4 pole	**CS 3-35**	**94.00**
	2	2	-	4	2	6	aux. block	**CS 3-26**	

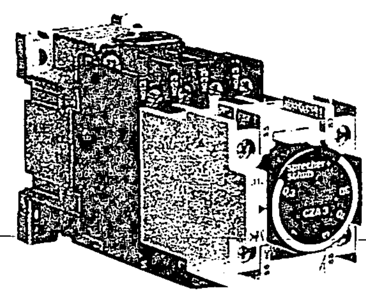
When ordering please specify voltage required	Price $
For non-standard coils	Add 10.00
Spare coils, standard voltages	25.00
Spare coils non-standard voltages	35.00

Standard voltages 24, 32, 110, 240, 415, 440, 480V 50 Hz

Dimensions (mm)

Notes:
[1]) Time delayed aux. contact
[2]) With aux. contact block
[3]) Basic device without adder elements
[4]) Fixing possibility onto mounting rail EN 50 022-35 for CS 3
[5]) With marking tag carrier





CS3 Relay with snap-on pneumatic timing head

Price Schedule 'A1'

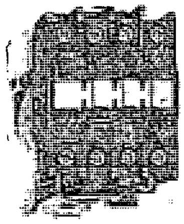
Sprecher + Schuh

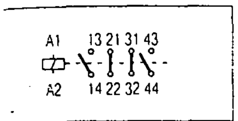
AC control relays
Type CS 3

Refer catalogue 2202

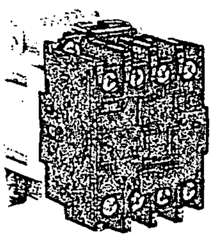
Heavy duty - 660V

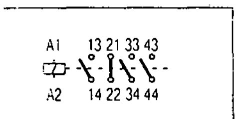
Complete relays - standard types



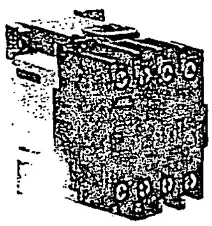


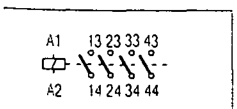
Control relay CS 3 basic design Cat. No. CS 3-22E





Cat. No. CS 3-31E





Cat. No. CS 3-40E

Preferred arrang. to EN 50 011 diagram	Arrang.	EN Refer. number	No. of contacts	Number N/O	Number N/C	Cat. No.	With std. coil Price $
A1 13 21 31 43 / A2 14 22 32 44		22 E	4	2	2	CS 3-22 E	66.00
A1 13 21 33 43 / A2 14 22 34 44		31 E	4	3	1	CS 3-31 E	66.00
A1 13 23 33 43 / A2 14 24 34 44		40 E	4	4	0	CS 3-40 E	66.00
A1 13 21 33 43 51 61 / A2 14 22 34 44 52 62	31 E + 02	33 E	6	3	3	CS 3-33 E	84.00
A1 13 21 31 43 53 61 / A2 14 22 32 44 54 62	22 E + 11	33 Y	6	3	3	CS 3-33 Y	84.00
A1 13 23 33 43 51 61 / A2 14 24 34 44 52 62	40 E + 02	42 E	6	4	2	CS 3-42 E	84.00
A1 13 21 33 43 53 61 / A2 14 22 34 44 54 62	31 E + 11	42 Y	6	4	2	CS 3-42 Y	84.00
A1 13 23 33 43 53 61 / A2 14 24 34 44 54 62	40 E + 11	51 E	6	5	1	CS 3-51 E	84.00
A1 13 23 33 43 53 63 / A2 14 24 34 44 54 64	40 E + 20	60 E	6	6	0	CS 3-60 E	84.00
A1 13 23 33 43 51 61 71 81 / A2 14 24 34 44 52 62 72 82	40 E + 04	44 E	8	4	4	CS 3-44 E	94.00
A1 13 21 31 43 53 61 71 83 / A2 14 22 32 44 54 62 72 84	22 E + 22	44 Y	8	4	4	CS 3-44 Y	94.00
A1 13 23 33 43 53 61 71 81 / A2 14 24 34 44 54 62 72 82	40 E + 13	53 E	8	5	3	CS 3-53 E	94.00
A1 13 21 33 43 53 61 71 83 / A2 14 22 34 44 54 62 72 84	31 E + 22	53 Y	8	5	3	CS 3-53 Y	94.00
A1 13 23 33 43 53 61 71 83 / A2 14 24 34 44 54 62 72 84	40 E + 22	62 E	8	6	2	CS 3-62 E	94.00
A1 13 23 33 43 53 61 73 83 / A2 14 24 34 44 54 62 74 84	40 E + 31	71 E	8	7	1	CS 3-71 E	94.00
A1 13 23 33 43 53 63 73 83 / A2 14 24 34 44 54 64 74 84	40 E + 40	80 E	8	8	0	CS 3-80 E	94.00

When ordering please specify voltage required	Price $
For non-standard coils	Add 10.00
Spare coils, standard voltages	25.00
Spare coils, non-standard voltages	35.00

Note: Standard voltages - 24, 32, 110, 240, 415, 440, 480 V, 50 Hz

Example:
Control relay CS 3-62-E
Reference numbers
Reference letters

Control relays

On control relays complying with the European Standard EN 50 011, the reference can be extended by a reference letter. The reference letters E and Y refer to preferred arrangements through which the location of the contacts and terminal markings are clearly specified. The arrangement digit is also the location digit. The CS 3 control relay arrangements shown in this catalogue at the present time having references with no reference letters, correspond to the contact arrangement most often used. The terminal markings comply with EN 50 005.

Schedule 'A1'

8

L

SECTION L

PHASE FAILURE RELAY

CROMPTON PSGW SERIES

PSGW 415V AC PHASE FAILURE RELAY

SUPPLIED BY: CROMPTON INDUSTRIES
20 CHATFORD STREET
MACGREGOR QLD 4109
TELEPHONE: (07) 841 1586

Phase Balance Relay

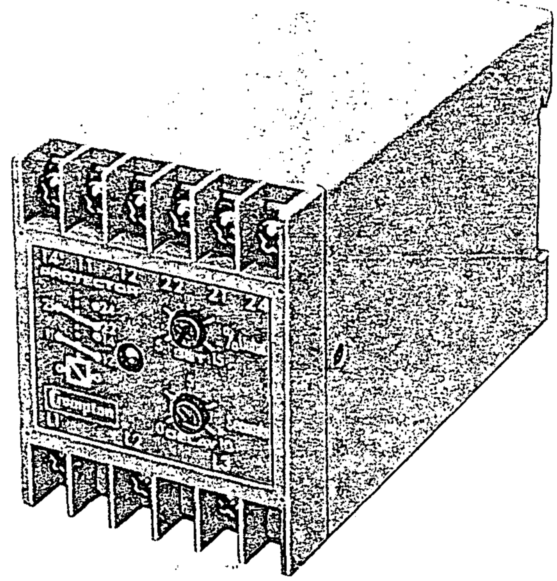
The Crompton **Protector** Phase Balance module provides continuous surveillance of a 3-phase, 3 or 4 wire system and protects against:

- ★ **Phase Loss**
- ★ **Phase Reversal**
- ★ **Sequence**
- ★ **Phase Unbalance**
- ★ **System Under Voltage**

The module de-energises a relay should any one of the above faults occur. It is fitted with an adjustable time delay to eliminate premature operation on short duration supply fluctuations.

A red LED indicates that the supply is within limits and that the output relay is energised. N.B. the relay will not energise if the supply is connected in the wrong sequence.

The phase unbalance feature protects motors of any size, from full-load to no-load, against excessive temperature rise due to unbalanced supplies, e.g. a 10% unbalanced supply can increase the temperature rise by 150%. In addition, this also protects against the phantom voltage generated during a single phase failure when running at low load.



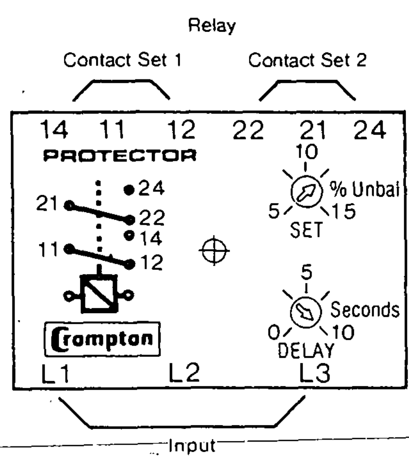
Principle of Operation

The module comprises monitoring circuits for voltage phase reversal and phase unbalance. Outputs from these circuits are fed to a comparator which changes state under fault conditions.

When the comparator switches, the output relay will de-energise after a pre-set time delay and the red LED will also de-energise in series.

The relay and LED will automatically energise again when all the supply parameters have returned to safe and acceptable limits.

Connection Diagram



Note: Neutral connection not required.

Specification

Type No:	252-PSFW. Phase loss and unbalance only 252-PSGW. Phase loss, unbalance and undervoltage.
Input	
System:	3 phase, 3 or 4 wire, 50 or 60Hz (specify)
Voltage Ratings:	100-125V, 200-250V or 380-450V (nominal voltage to be specified when ordering)
Burden:	3VA
Voltage Withstand:	1.2 times continuous 1.5 times for 10 x 10s To B.S. 6253
Set Points	
Unbalance:	Adjustable 5% to 15%
Time Delay:	200ms to 10s adjustable (not operative if voltage falls below 70% of nominal or set point or type 252-PSGW)
Under Voltage: (Type 252-PSGW only):	Internally reset at – 15% nominal voltage (other values between – 10% and – 30% available on request)
Output Relay	
Type:	DP changeover
Rating ac:	240V, 5A non-inductive
dc:	24V, 5A resistive
Operations:	2 x 10^5 at above load
Reset:	Automatic
Weight:	Approx. 0.3kg

M

SECTION M

AMMETERS & VOLTMETERS

CROMPTON 244 SERIES

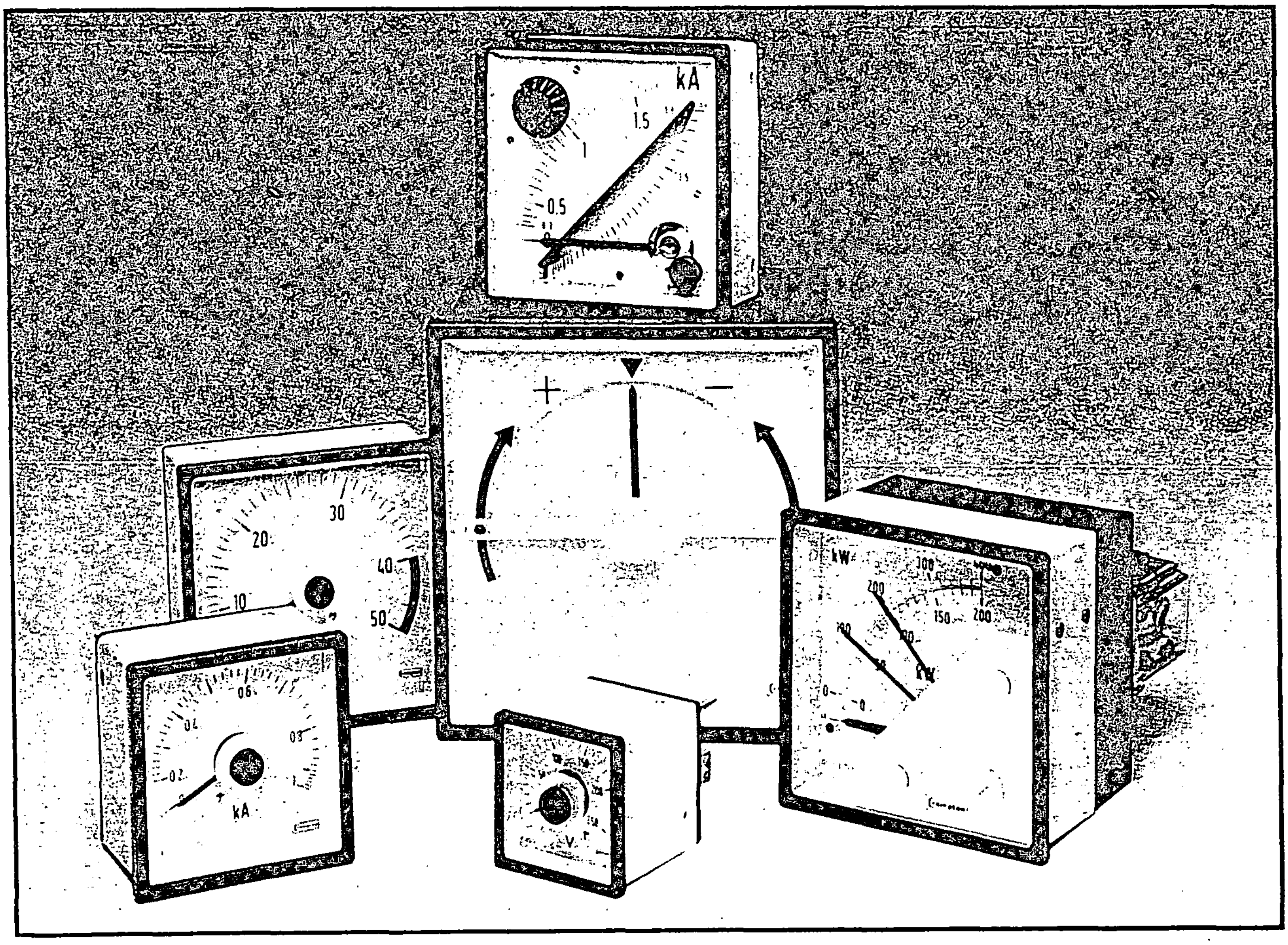
244-026G 0-400A AMMETER
244-02AG 0-500A 5A C/T AMMETERS
244-02VG 0-500V VOLTMETER
244-026G 0-10A AMMETER

SUPPLIED BY: CROMPTON INDUSTRIES
20 CHATFORD STREET
MACGREGOR QLD 4109
TELEPHONE: (07) 841 1586

CROMPTON

HAWKER SIDDELEY
Crompton
INSTRUMENTS

Quadratic 240 Series



SC240 Edition 1

Quadratic
240 Series

Hawker Siddeley Crompton Instruments

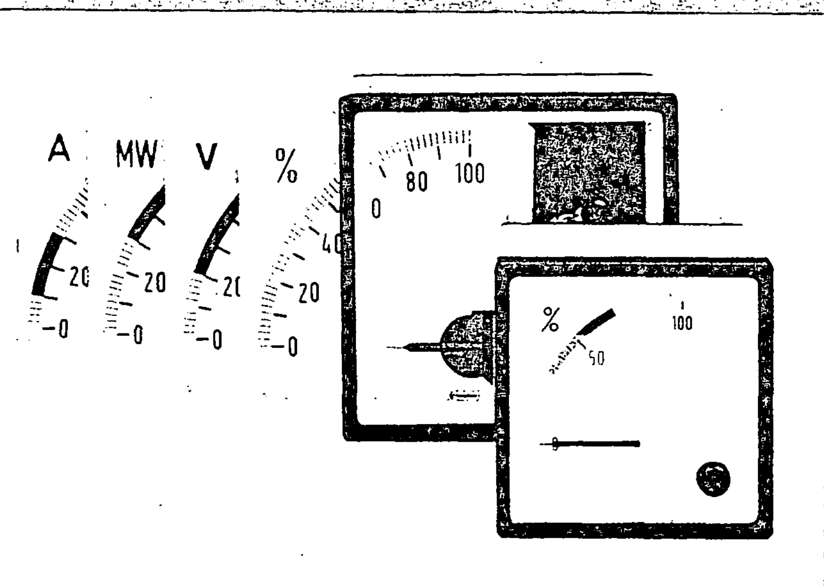
Selection table

Symbol	Movement	Page	242 (90°) 48 x 48	243 (90°) 72 x 72	244 (90°) 96 x 96	246 (90°) 144 x 144	242 (240°) 48 x 48	243 (240°) 72 x 72	244 (240°) 96 x 96	246 (240°) 144 x 144
A V	Moving Iron	4	●	●	●	●	●	●	●	●
A V	Moving Coil	4	●	●	●	●	●	●	●	●
A	Maximum Demand Indicators	4	–	●	●	●	–	–	–	–
A	Moving Iron + MDI	4	–	–	●	●	–	–	–	–
W VAR	Wattmeter Varmeter	5	*	*	●	●	*	*	●	●
cos φ	Phase Angle meter	5	*	*	●	●	*	*	●	●
cos φ	Power Factor meter. 360° scale	5	–	–	–	–	–	–	●	●
Hz	Frequency meter – pointer type	5	●	●	●	●	*	*	●	●
Hz	Frequency meter – reed type	6	–	●	●	–	–	–	–	–
V	Synchronising Voltmeter	6	–	–	●	–	–	–	–	–
	Synchroscope. 360° scale	6	–	–	–	–	–	–	●	●
	Phase Sequence Indicator	6	–	–	●	–	–	–	–	–
A V	Moving Coil Rectifier	7	●	●	●	●	●	●	●	●
	Position Indicator	7	*	*	*	*	*	*	●	●
rev/min	Speed Indicator	7	●	●	●	●	●	●	●	●
°C	Temperature Indicators	7	*	*	*	*	*	*	●	●
999999 h	Elapsed Time Meter	8	●	●	●	–	–	–	–	–
	Meter Relay	8	–	–	●	–	–	–	–	–
	Current Transformers, Shunts, Transducers	8								
	Connection diagrams	9-11								
	Dimensions	12								

● self contained
* with separate transducer
– not presently in range

Features

★ Shock-resistant taut band suspension
★ Vibration-proof Hi-Q damping
★ Suitable for tropical climates
★ Customised options & extras
★ Complementary transducers, current transformers, shunts, tachogenerators
★ 90° and 240° scale
★ Slide in dials for 90° volts amp frequency



Standards

All instruments comply with the following specifications:

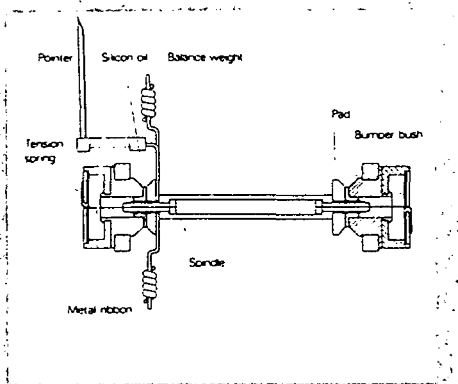
Case dimensions	DIN43700
Benzels (slim)	DIN437.18
Scale markings	DIN43802
Magnetic influence	DIN43780
Performance, Accuracy, Overloads	IEC 51
Measuring ranges	DIN43701
Safety requirements	IEC414
Dial symbols	IEC51
Enclosure	IEC529

Optional compliance on request
Lloyds Marine
National Area Boards
Spec ES141 - 26 + 50 + 8

Quadratic 240 Series

HAWKER SIDDELEY Crompton INSTRUMENTS

Hi - Q Taut Band Suspension



In the Crompton world-patented 'Hi-Q' taut band suspension (see diagram) all the delicate parts of the traditional instruments are elminated. There are no pivots, no jewel bearings, no hair springs, no air damping vane. Instead, a tough metal ribbon suspends the moving element between front and rear tension springs.

Specially contoured pads are fitted to the ends of the spindle and the working gap at each end is filled with a high quality silicon fluid. The pads, together with the fluid reservoir, form a system which acts as resilient built-in shock absorbers. This provides both rotational and longitudinal damping as the moving element floats on oil with no bearing friction and is effectively cushioned against shock and vibration.

360° synchroscopes and power factor meters have robust pivot and jewel bearings.

All movements are self-shielded against external magnetic fields as defined in BS89, IEC51 and DIN 43780.

Construction

Models 242, 243 and 244 have cases, bezels and terminal plates injection moulded in flame retardent engineering thermoplastic recognised by Underwriters Laboratory (UL).

Model 244 Meter Relay and all model 246 have pressed steel cases.

All instruments have glass windows, with zero adjusters where necessary. Non-reflecting glass or polycarbonate shatterproof windows are available.

Enclosure

The cases comply with enclosure code IP54 to IEC 529. They are suitable for use in tropical conditions.

Specification

Performance

Instruments comply with IEC51.

Accuracy

Class 1.5 is standard. Frequency meters offer Class 0.5 or 0.2. Maximum demand indicators are Class 3. Synchroscopes and 360° power factor meters are Class 2.5 (2° electrical).

Overload withstand

1.2 times rated current or voltage for 2 hours. Ammeters 10 times rated current, voltmeters and frequency meters 2 times rated voltage for 5 seconds. Power instruments accept similar overloads.

Dielectric test

2kV a.c. for 1 minute.

Ambient Temperature

Instruments have a working ambient range of -20°C to 60°C (70°C Lloyds) with relative humidity up to 90%. They are calibrated for other temperatures within the working range can be specified. (Lloyds Shipping at 35°C)

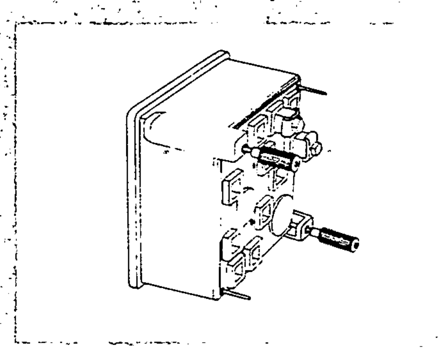
Damping time

$\leq$ 3 seconds is usual. More heavily damped movements are available on request.

Illumination

Internally illuminated dials are available for Models 243, 244 and 246, 240° moving coil. The replaceable rear mounted lamps are supplied for 6, 12 or 24V.

Mounting Clamps



Models 242, 243 and 244 are provided with two corner fixing clamps and tensioning thumb screws.

Dials and Scales

Standard dials are acrylic matt white with black printed scales and bar pointers.

They are scaled in accordance to DIN 43802. Interchangeable slide-in dials are used on models 243 and 244 short scale moving iron and moving coil.

360° Instruments have platform dials.

Black dials with white or yellow scales and pointers are available.

General options include red supplementary pointers, red indexes (quadrant scales), red, green or blue lines, bands or segments, finely spaced divisions, multi-scales and special scales and captions to customers' requirements.

All 243 and 244 90° scale voltmeters, ammeters and frequency meters have slide in dial, offering the benefit of low stock costs as only the basic instruments types need to be stocked together with ranges of dials. Other dials can be obtained rapidly from our local sales and service centres or agents.

Mounting Angle

Standard instruments are calibrated for mounting on a vertical panel.

Special calibration for other mounting positions can be provided on request. Specify the angle of inclinations required in degrees, α° from the horizontal.

World Patents

Crompton indicators incorporate features covered by one or more of the following patents:

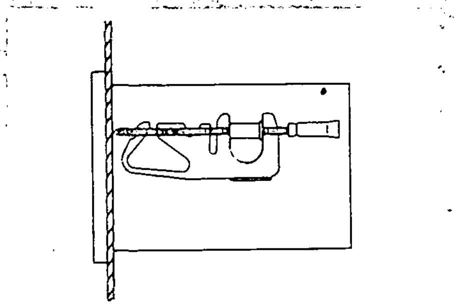
GREAT BRITAIN: 1,124,667, 1,295,935, 1,212,245, 29,466/77

AUSTRALIA: 415, 321

CANADA: 792,902, 846,338

GERMANY: 1,591,864, P1,591,864.6, P.2747965.8, G7732975.0

U.S.A: 3,439,273, 3,590,375, 845032.

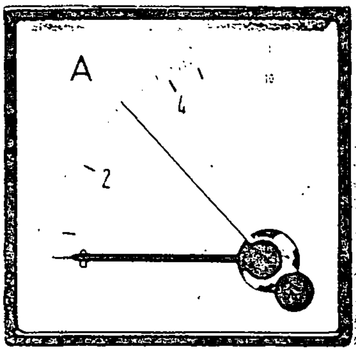


Model 246 and Meter Relay model 244-30, have two side fixing spring clips.

Quadratic 240 Series

HAWKER SIDDELEY Crompton INSTRUMENTS

A&V~



Moving Iron

Designed to measure a.c. current or voltage, these rugged movements indicate true r.m.s. values substantially independent of system wave form.

Scales are calibrated down to 20%. Ammeters can have overload scales x 2 or x 6 for motor start duty. Heavy damping is available.

Ammeters are scaled for use with -/1A or -/5A current transformers for high ratings or remote indication.

Calibration for d.c. can be arranged on 90° ratings.

Accuracy

Class 1.5 (Class 2 model 242 90° scale)

Ratings

Ammeters:
0.5A to 100A direct connected (25A for 242-90° & 240° scales)
Ratings for use with C.T.s.
Scales with x 2 or x 6 overload.
Low load scales (max 10A).

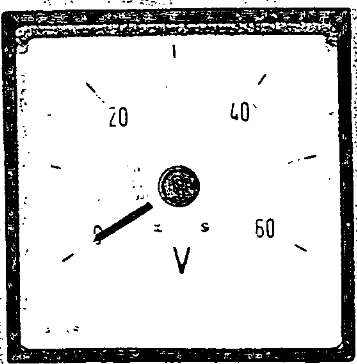
Voltmeters:
6V to 600V direct connected.
100, 133, 140, 150V for use with V.T.s.

Frequency 50 or 60 Hz. 400 Hz on request.

Burden at 50Hz.

Ammeters: 90° – 0.5VA, 240° – 1.5VA.
Voltmeters: 4.5VA max.

A&V



Moving Coil

These self-shielded high-torque movements are suitable for all d.c. systems. The linear scale is calibrated down to zero and accuracy maintained down to 10%.

High current ratings are measured with separate shunts and suitably scaled indicators.

Suppressed, centre or off-set zero models are available and indicators can be calibrated for use with tachogenerators, transducer outputs, process signals and similar electrical sensors.

Model 242 – 90° scale has a pivotted movement and eddy current damping.

Accuracy

Class 1.5

Ratings

Ammeters:
100µA to 25A direct connected.
4/20mA suppressed zero.

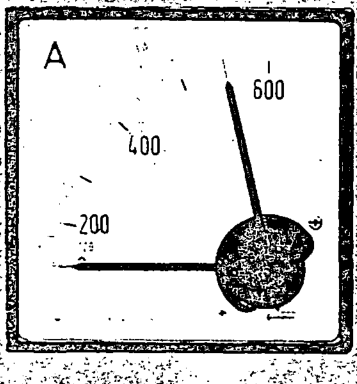
Voltmeters:
60mV to 600V direct connected.
1/5V suppressed zero.
60, 75, 150mV for use with shunts.

Impedance

Voltmeters: 1000Ω/V above 1V.
Ammeters: 75mV internal shunt above 60mA.

For values see publication T118.

A



Maximum Demand Indicator

The thermal/time characteristic of MDIs monitors the most economic use of cable, fusegear and transformers.

The directly heated bimetal element indicates mean r.m.s. current over 8, 15 or 20 mins. A red slave pointer shows highest value reached and has a wire sealable reset knob.

The optional saturating C.T. limits the power into the MDI and is used where a protection relay is connected in series from the same C.T. Scales are calibrated to match the C.T. plus 20% overload (e.g. 0-5-6A).

Accuracy Class 3

Ratings

5A for use with separate C.T.
5/5A saturating C.T. (dim. 'C' page 12 becomes 83mm)

Burdens 50/60Hz

MDI – 2.5VA, CT – 2VA

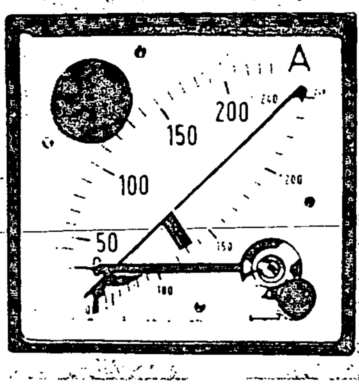
Overload withstand

Standard: 5 x FL for 5 sec
10 x FL for 1 sec
With saturating C.T.: 10 x FL for 3 sec
20 x FL for 1 sec

Frequency 50/60Hz

Models 243, 244, 90° scale

A



Moving Iron + MDI

Where the instantaneous and maximum demand currents are required, this instrument combines both movements in one case. It can replace an existing M.I. ammeter.

The scales are calibrated to match the C.T. primary plus 20% overload. End values are selected from: 1.2 1.8 2.4 3 3.6 4.8 6 7.2 9 and their multiples of 10 and 100.

Accuracy

Bimetal element	Class 3
Moving iron ammeter	Class 1.5

Ratings

5A for use with separate C.T.
5/5A saturating C.T. (dim. 'C' page 12 becomes 83mm).

Burdens 50/60Hz

MDI – 2.5VA, CT – 2VA, MI – 0.5VA.

Overload withstand

Standard: 5 x FL for 5 sec
10 x FL for 1 sec
With saturating C.T.: 10 x FL for 3 sec
20 x FL for 1 sec

Frequency 50/60Hz

Model 244, 90° scale only.

Quadratic 240 Series

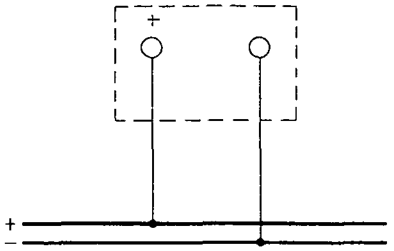
HAWKER SIDDELEY Crompton INSTRUMENTS

Symbols based on DIN43 807. Transformer terminal markings to BS3938/3941.

VOLTMETER d.c.

-89VG
-01VG
-10VG
-05VG

Direct connected (max. 600V)



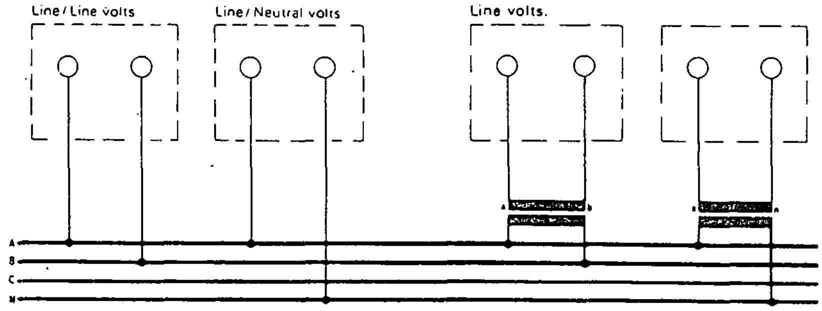
VOLTMETER a.c.

·02VG, ·07VG, ·03VG, ·78VG
-89WG, -01WG, -10WG, -05WG

Direct connected (max. 600V)

Line/Line volts — Line/Neutral volts

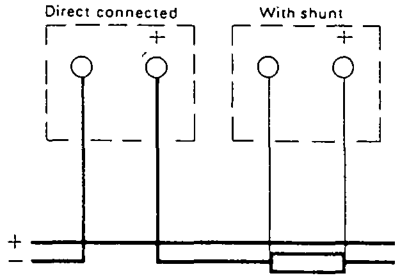
With voltage transformer
Line volts.



AMMETER d.c.

-89AG
-01AG
-10AG
-05AG

Direct connected — With shunt



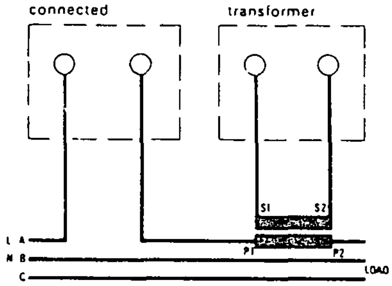
AMMETER a.c.

Moving iron
-02AG, -022G, -026G
-07AG, -072G, -076G
-03AG, -032G, -036G
-78G

Moving Coil Rectifier
-89BG, -01BG, -10BG, -05BG

MDI and MDI plus MI
-16AG, -16BG
-16CG, -16DG

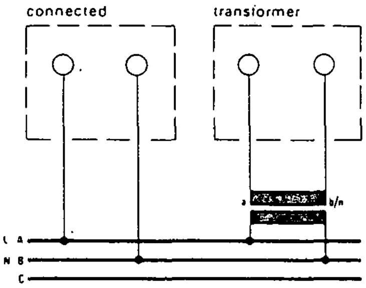
Direct connected — With current transformer



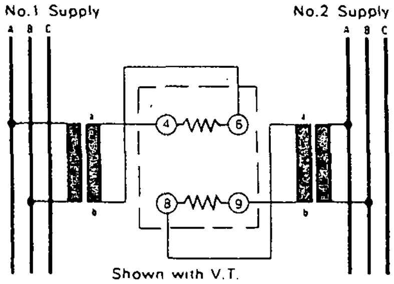
FREQUENCY AND ELAPSED TIME METERS

·41SG, ·197G, ·19RG
·41LG, ·199G, ·19SG
·155G, ·156GG

Direct connected — With volt transformer



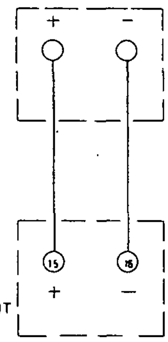
Double vibrating reed
·19TG



Shown with V.T.

TRANSDUCER INDICATOR

-89, -01, -10, -05 — AG, VG, 3G, 4G, 5G, 6G, 7G

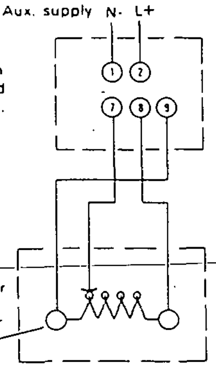


Separate 250 series transducer. See SW25DIT & SW250T for Watts, Vars, Frequency, Amps, Volts, Phase angle, Resistance, Temperature, Position etc.

POSITION INDICATOR

·45QB
·45PB

Indicator with self-contained power source.

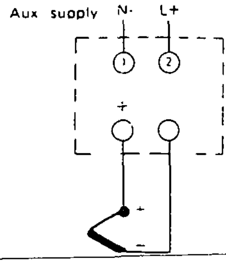


Customers Potentiometer

No.1 tap

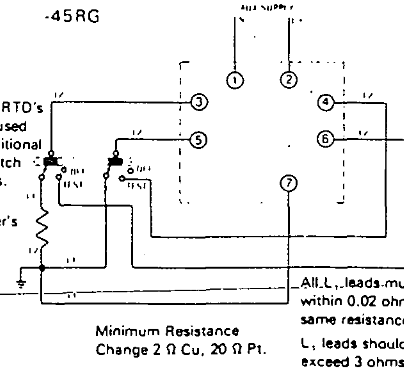
TEMPERATURE INDICATORS

·45TG



Customers Thermocouple

·45RG



Multiple RTD's may be used with additional RTD switch positions.

Customer's RTD

Minimum Resistance Change 2 Ω Cu, 20 Ω Pt.

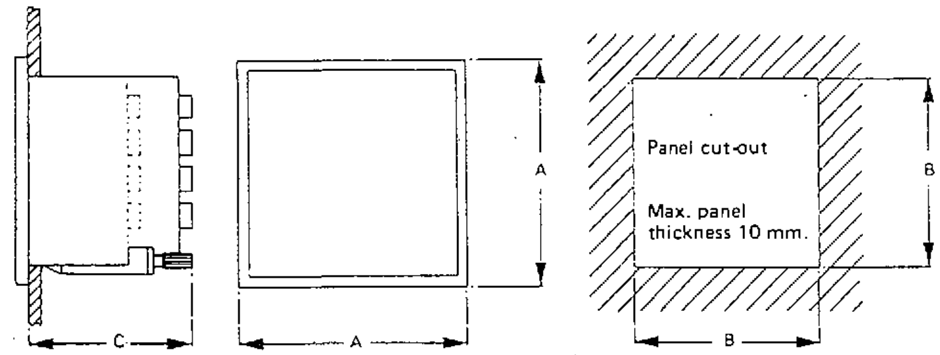
All L leads must be within 0.02 ohms of the same resistance.
L_1 leads should not exceed 3 ohms each.
L_2 leads should not exceed 0.02 ohms each.

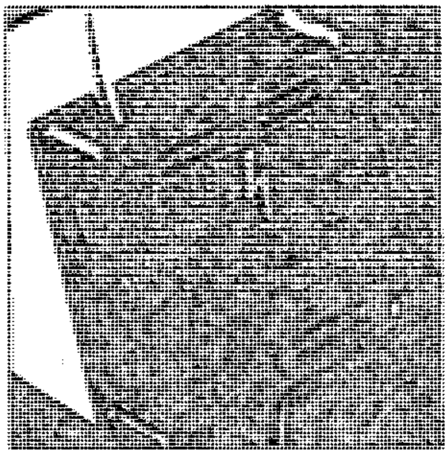
Quadratic 240 Series

HAWKER SIDDELEY Crompton INSTRUMENTS

Dimensions

Case sizes to DIN43700. Narrow bezels to DIN43718.



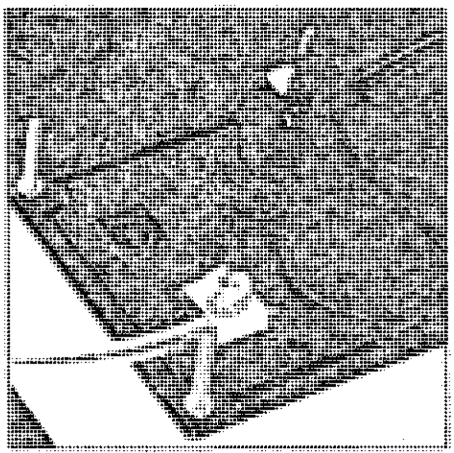


Base cover available for 243 and 244 Slide - in dial instruments only.

Model	242	243	244	246
Bezel 'A'	48 x 48	72 x 72	96 x 96	144 x 144
Panel cut-out 'B'	45 x 45	68 x 68	92 x 92	138 x 138
Scale length: 90°	42	65	94	145
" " 240°C	72	112	150	230
Maximum overall depth 'C'	**242**	**243**	**244**	**246**
Ammeter and Voltmeter	75	78	78	95
Maximum Demand Indicator		78	78	95
Wattmeter, VArmeter – 90°	★	★	87	145
– 240°	★	★	145	145
Phase Angle, Power Factor Meter – 90°	★	★	65	•
– 240°	★	★	126	•
Frequency Meter – 90°	★	78	78	95
– 240°	★	★	140	131
★M.C. Indicator with separate transducer	75	78	78	95
Reed Frequency Meter	–	78	78	–
Synchronising Voltmeter	–	–	78	–
Synchroscope, 360° Power Factor Meter	–	–	140	131
Phase Sequence Indicator	–	–	78	–
Position Indicator	★	★	140	131
Speed Indicator	75	78	78	95
Temperature Indicators	–	–	140	131
Elapsed Time Meter	–	78	78	–
Meter Relay	–	–	120	–

Terminals: Voltage and current up to 30A — M5 screw clamps. Current above 30A — M8 studs with nuts.

★ Dimensions of external transducers for use with moving coil indicators are given in publication SW250IT or SW250T.



Terminal Boot available for all Quadratic Instruments.

The information contained in this specification is correct at the time of publication, but the right is reserved to supply instruments differing in construction and appearance from those illustrated and described.

CROMPTON INSTRUMENTS (AUSTRALIA) PTY. LTD.

HEAD OFFICE:
N.S.W. Unit 20, Minto Industrial Park, 25-31 Airds Road, Minto, N.S.W. 2566 .... Ph: 02 603 2066 Fax: 02 603 9335

BRANCH OFFICES:
S.A. 350 Torrens Road, Croydon Park, S.A. 5008 .... Ph: 08 347 1522 Fax: 08 347 3094
VIC. 3 Chesterville Road, Cheltenham, Vic. 3192 .... Ph: 03 584 8844 Fax: 03 584 1042
W.A. Suite 1, 929 Wellington Street, West Perth, W.A. 6005 .... Ph: 09 321 4387 Fax: 09 321 8901

QUEENSLAND AGENTS:
Bartlett Marketing Co. Pty. Ltd., Underwood, Qld. 4119 .... Ph: 07 841 1586 Fax: 07 841 1676
Industrial & Marine Electrics, Cairns, Qld. 4870 .... Ph: 070 35 2722 Fax: 070 35 2723
Marcon Agencies Pty. Ltd., Garbutt, Qld. 4818 .... Ph: 077 25 4499 Fax: 077 25 4511

N.S.W. AGENTS:
Excell Control Pty. Ltd., Unanderra, N.S.W. 2526 .... Ph: 042 72 1922 Fax: 042 72 1833
Borg Electrical Wholesalers Pty. Ltd., Broadmeadow, N.S.W. 2292 .... Ph: 049 52 4366 Fax: 049 52 7490

TASMANIAN AGENTS:
George Harvey Electric Pty. Ltd., Hobart, Tas. 7000 .... Ph: 002 34 2233 Fax: 002 31 1347
~~George Harvey Electric Pty. Ltd., Launceston, Tas. 7250~~ .... Ph: 003 31 6533 Fax: 003 34 1899

NORTHERN TERRITORY AGENT:
I.S.A.S., Winnellie, N.T. 0820 .... Ph: 089 47 2313 Fax: 089 47 0149

SOUTH PACIFIC ISLANDS:
Export Procurement Pty. Ltd., Northgate, Qld. .... Ph: 07 260 5499 Fax: 07 260 5546

NEW ZEALAND AGENT:
Electrade Limited, Auckland. .... Ph: 09 525 1031 Fax: 09 525 1756

N

SECTION N

SELECTOR SWITCHES

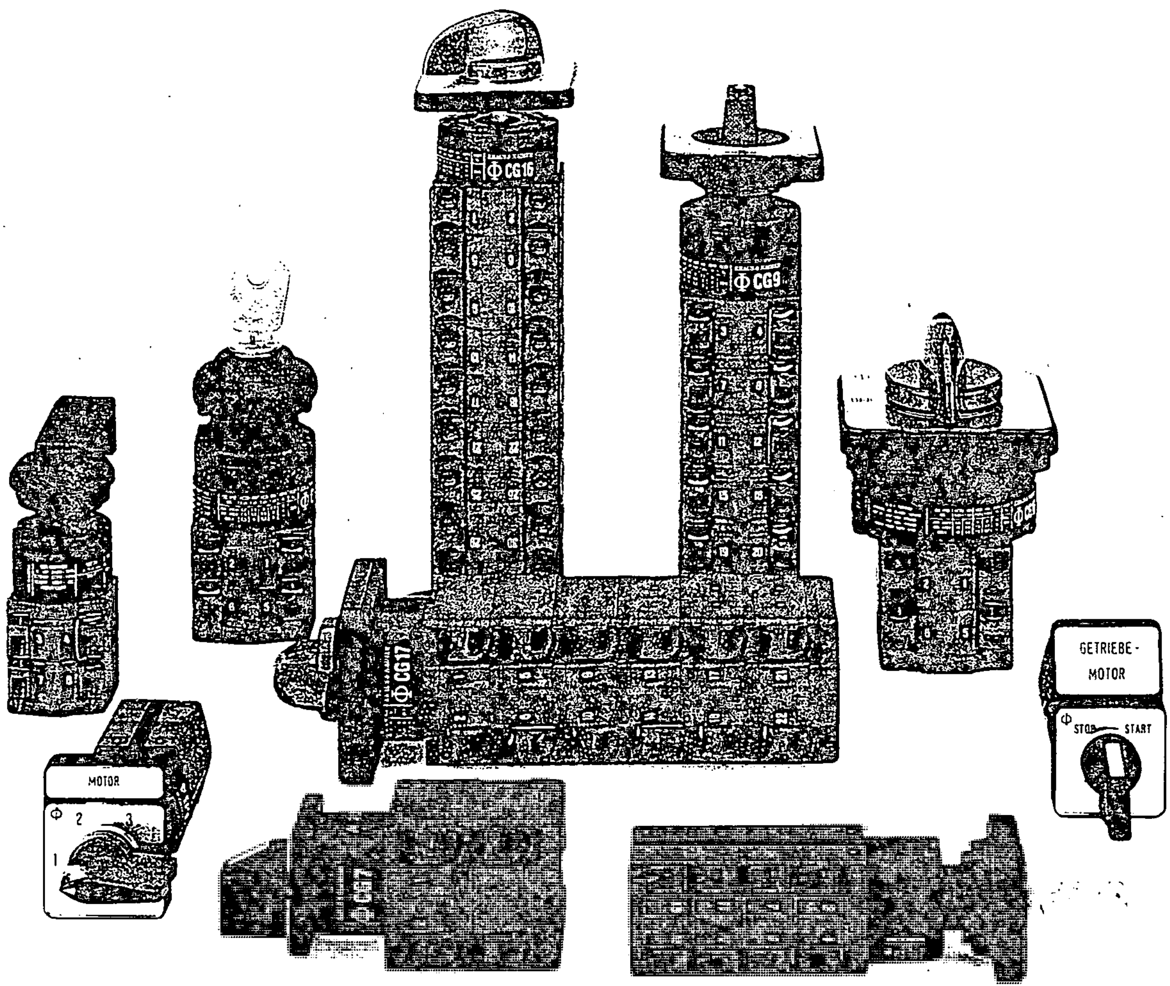
KRAUS & NAIMIER CG8 SERIES

CG8-A007-621-FT2 VOLTMETER SELECTOR SWITCH
CG8-A223-600-FT2 START MODE SELECTOR SWITCH
CG8-A221-600-FT2 START MODE SELECTOR SWITCH
CG8-A369-600-FT2 EMERGENCY MODE SELECTOR SWITCH
CG8-A200-621-FT2 LIGHTING SELECTOR SWITCH

SUPPLIED BY: AUSTRALIAN SOLONOID PTY LTD
22 BROOKES STREET
BOWEN HILLS QLD 4006
TELEPHONE: (07) 2528344

KRAUS & NAIMER
BLUE LINE SWITCHGEAR

Catalog 120
CG-SWITCHES
10 A - 25 A



CONSTRUCTION DATA

Cam switches of the CG series are designed for universal application and may ideally be used for control switches, instrumentation switches and motor control switches with high AC 11-, AC3- and/or AC23 switching capability. All switches of the CG 4-1 type are particularly suitable for low voltage switching. This facilitates the use of the CG 4 series even in electronic circuitry as well as in aggressive environments.

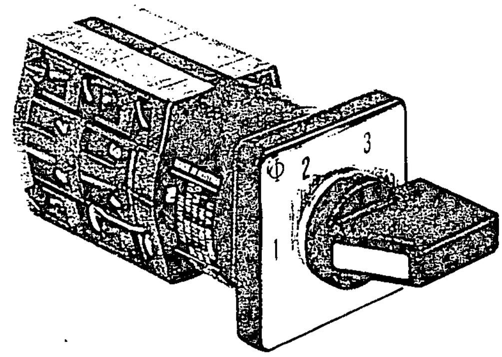
All switches of this series are supplied with open terminals which are accessible while the switch is installed. The terminals as well as any terminal connection are protected against accidental finger contact in accordance with VDE 0660, section 100 (VGB 4). Captive plus-minus terminal screws and integrated screwdriver guides facilitate wiring. Due to the particular axial arrangement of the terminals, it is possible to install the switches closely, side by side, or to mount them directly at the cable trays. The contact terminal numbers are easy to read, even if the switch is installed.

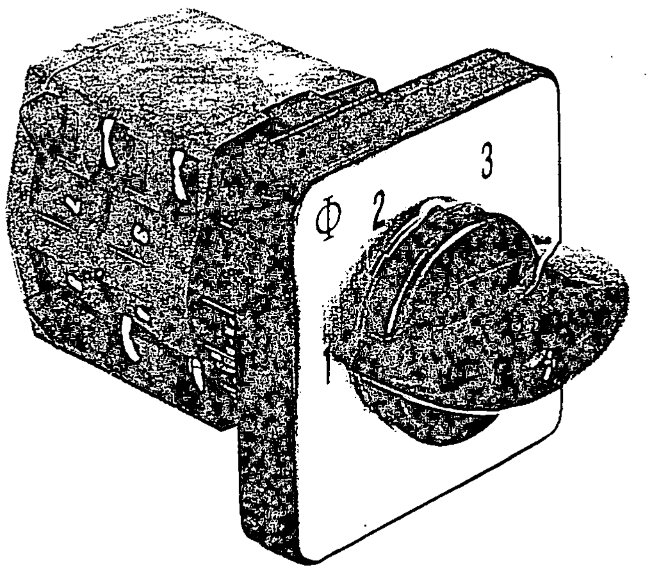
Switch types CG4, CG4-1, CG6 and CG7 are equipped with the escutcheon plate size 30 x 30 mm (1.181" × 1.181"). These switches offer maximum space saving benefits. The escutcheon plate is designed to match push-button and indicator units. A single hole mounting with protection grade IP65 is suitable for either 16 or 22 mm and 22 or 30 mm mounting dimensions and is available with key operator, if required.

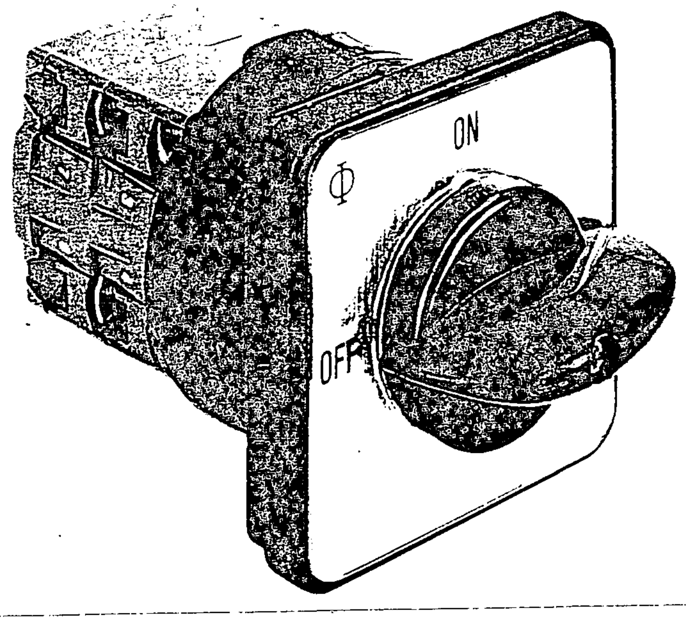
CG4 and CG4-1 contacts are supplied standard with gold plating 0,3 or 35 µ. Hereby a higher contact security is guaranteed.

Switching angle of CG switches may be 30°, 45°, 60° or 90°. The maximum number of contacts differs and depends on the particular type of switch.

CG4 and CG4-1	= 16 contacts
CG6 and CG7	= 8 contacts
CG8, CG9, CG16, CG17, CG16B and CG17B	= 24 contacts







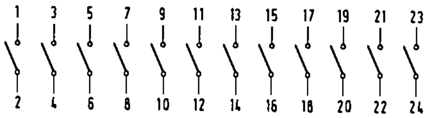
SWITCH FUNCTION AND CONFIGURATION

CG-SWITCHES

ON/OFF SWITCHES WITH 60° SWITCHING

FUNCTION	ESCUTCH. PLATE	TYPE/HANDLE CG4 CG4-1	CG6 CG7	CG8- CG17	CG16B CG17B	CODE-NO.	STAGES
1 pole						A200-600	1
2 pole						A201-600	1
3 pole						A202-600	2
3 pole with red handle						A202-626	2
3 pole with V850 padlock attachement						A202-627	2
4 pole						A203-600	2
5 pole						A341-600	3
6 pole						A342-600	3
7 pole						A343-600	4
8 pole						A344-600	4
9 pole						A345-600	5
10 pole						A346-600	5
11 pole						A347-600	6
12 pole						A348-600	6
1 pole						A200-620	1
2 pole						A201-620	1
3 pole						A202-620	2
4 pole						A203-620	2
5 pole						A341-620	3
6 pole						A342-620	3
7 pole						A343-620	4
8 pole						A344-620	4
9 pole						A345-620	5
10 pole						A346-620	5
11 pole						A347-620	6
12 pole						A348-620	6
1 pole						A200-621	1
2 pole						A201-621	1
3 pole						A202-621	2
4 pole						A203-621	2
5 pole						A341-621	3
6 pole						A342-621	3
1 pole						A200-622	1
2 pole						A201-622	1
3 pole						A202-622	2
4 pole						A203-622	2
5 pole						A341-622	3
6 pole						A342-622	3
1 pole						A200-623	1
2 pole						A201-623	1
3 pole						A202-623	2
4 pole						A203-623	2
5 pole						A341-623	3
6 pole						A342-623	3
1 pole						A200-624	1
2 pole						A201-624	1
3 pole						A202-624	2
4 pole						A203-624	2
5 pole						A341-624	3
6 pole						A342-624	3
1 pole						A200-625	1
2 pole						A201-625	1
3 pole						A202-625	2
4 pole						A203-625	2
5 pole						A341-625	3
6 pole						A342-625	3

CONNECTING DIAGRAM



1 - 12 pole

6

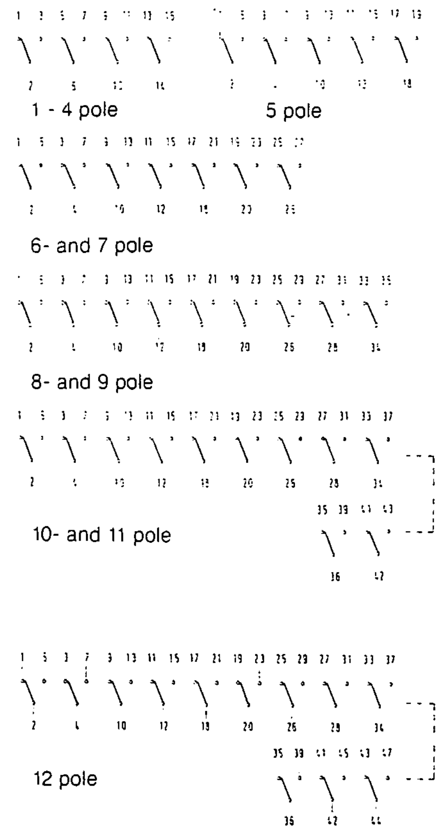
SWITCH FUNCTION AND CONFIGURATION

CG-SWITCHES

DOUBLE-THROW SWITCHES WITHOUT 'OFF' 60° SWITCHING

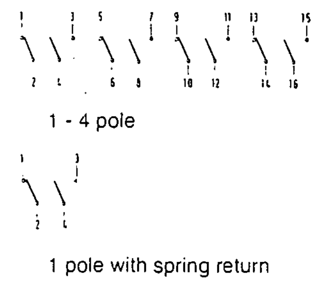
FUNCTION	ESCUTCH. PLATE	TYPE/HANDLE CG4 CG4-1	CG6 CG7	CG8- CG17	CG16B CG17B	CODE-NO.	STAGES
1 pole						A220-600	1
2 pole						A221-600	2
3 pole						A222-600	3
4 pole						A223-600	4
5 pole						A369-600	5
6 pole						A370-600	6
7 pole						A371-600	7
8 pole						A372-600	8
9 pole						A373-600	9
10 pole						A374-600	10
11 pole						A375-600	11
12 pole						A376-600	12

CONNECTING DIAGRAM



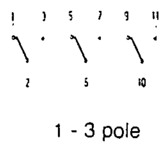
DOUBLE-THROW SWITCHES WITHOUT 'OFF' with electrically isolated contacts

FUNCTION	ESCUTCH. PLATE	CG4 CG4-1	CG6 CG7	CG8- CG17	CG16B CG17B	CODE-NO.	STAGES
1 pole						A720-600	1
2 pole						A721-600	2
3 pole						A722-600	3
4 pole						A723-600	4
1 pole with spring return						A795-600	1



DOUBLE-THROW SWITCHES with spring return

FUNCTION	ESCUTCH. PLATE	CG4 CG4-1	CG6 CG7	CG8- CG17	CG16B CG17B	CODE-NO.	STAGES
1 pole						A295-600	1
2 pole						A296-600	2
3 pole						A297-600	3
1 pole						A295-620	1
2 pole						A296-620	2
3 pole						A297-620	3



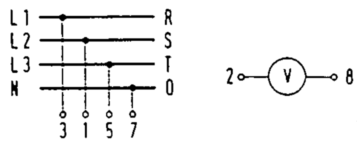
SWITCH FUNCTION AND CONFIGURATION

CG-SWITCHES

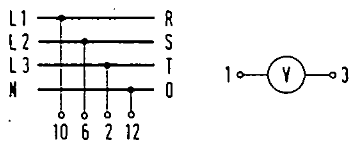
FUNCTION	ESCUTCH. PLATE	TYPE/HANDLE CG4 CG4-1	CG6 CG7	CG8- CG17	CG16B CG17B	CODE-NO.	STAGES	CONNECTING DIAGRAM

VOLTMETER SWITCHES WITH 'OFF'

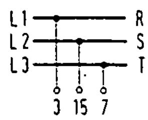
FUNCTION	CODE-NO.	STAGES
3 phase to neutral	A005-600	2
	A005-620	2
	A005-621	2
	A005-622	2
	A005-623	2

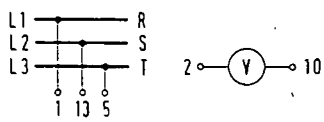


FUNCTION	CODE-NO.	STAGES
3 phase to phase and 3 phase to neutral	A007-600	3
	A007-620	3
	A007-621	3
	A007-622	3
	A007-623	3
	A007-624	3



FUNCTION	CODE-NO.	STAGES
2 separate 3 phase with center 'off'	A008-600	4
	A008-620	4
	A008-621	4
	A008-622	4





TECHNICAL DATA — CG-SWITCHES

SELECTION DATA					CG4	CG4-1	CG6 CG8	CG7 CG9	CG16 CG16B	CG17 CG17B
NOMINAL VOLTAGE		IEC/VDE/BS		V	500	500	500	660	500	660
		UL/CSA		V	300	300	300/150	600	300/150	600
		SEV max.		V	380	380	500	660	500	660
		CEE 24/NEMKO		V	380	380	380	380	380	380
MAIN SWITCH VOLTAGE RATING		Isolation in accordance with VDE		V	250	250	380	380	380	380
THERMAL CURRENT I_{th}		IEC/VDE/BS		A	10	10	20	20	25	25
		UL/CSA		A	10	10	16	16	25	25
		SEV max.		A	10	10	16	16	25	25
NOMINAL CURRENT I_e										
AC 21	Switching of resistive loads, including moderate overloads	IEC/VDE/BS		A	10	10	20	20	25	25
AC 1	Resistive or low inductive loads	SEV	380 V	A	10	10	16	16	25	25
			500 V	A	-	-	10	10	20	20
			660 V	A	-	-	-	10	-	20
AC 22	Switching of combined resistive or low inductive loads, including moderate overloads	IEC/VDE/BS	220-500 V	A	10	10	20	20	25	25
			660 V	A	-	-	-	16	-	25
AC 11	Switching of control devices, contactors, valves etc.	IEC/VDE	220 - 240 V	A	2,5	2,5	6	6	8	8
			380 - 440 V	A	1,5	1,5	4	4	5	5
Pilot Duty		UL/CSA	Heavy	VAC	300	300	300/150	600	300/150	600
Ampere-Rating	Resistive or low inductive loads	UL/CSA		A	10	10	16	16	25	25
Resistive load/Motor load		CEE 24		A	4/2	4/2	10/7	10/7	16/10	16/10
		NEMKO		A	6/4		10/6		16/10	
SHORT CIRCUIT PROTECTION										
	Max. fuse size	(gL-characteristic)		A	10	10	25	25	35	35
	Rated conditional short-circuit current			kA	3	3	5	5	10	10

DC SWITCHING CAPACITY — NOMINAL CURRENT I_e

No. of series contacts	1	2	3	4	5	6	8		CG4	CG4-1	CG6 CG8	CG7 CG9	CG16 CG16B	CG17 CG17B
	Voltage V													
DC 1 Resistive loads $T \lesssim 1$ ms	24	48	70	95	120	144	190	A	10	10	16	16	25	25
	48	95	140	190	240	290	350	A	6	6	12	12	20	20
	60	120	180	240	300	360	450	A	2,5	2,5	4,5	4,5	7,5	7,5
	110	220	330	440	550	660	-	A	0,7	0,7	1	1	1,5	1,5
	220	440	660	-	-	-	-	A	0,3	0,3	0,4	0,4	0,5	0,5
	440	660	-	-	-	-	-	A	0,2	0,2	0,25	0,25	0,3	0,3
Inductive loads T = 50 ms	24	48	72	96	120	144	190	A	6	6	12	12	20	20
	30	60	90	120	150	180	240	A	3	3	5	5	9	9
	48	95	140	190	240	290	350	A	1	1	2	2	3	3
	60	120	180	240	300	360	450	A	0,7	0,7	1	1	1,5	1,5
	110	220	330	440	550	660	-	A	0,3	0,3	0,4	0,4	0,5	0,5

TECHNICAL DATA

CG-SWITCHES

SELECTION DATA					CG4	CG4-1	CG6 CG8	CG7 CG9	CG16 CG16B	CG17 CG17B
MOTOR RATING		IEC/VDE/BS								
AC 2	Slip ring motor starting, reversing and plugging, star-delta starting	3 phase 3 pole	220 V	kW	2,5	2,5	4	4	5,5	5,5
			380 V	kW	4,5	4,5	7,5	7,5	11	11
			415 V	kW	4,5	4,5	7,5	7,5	11	11
			440 V	kW	4,5	4,5	7,5	7,5	11	11
			500 V	kW	5,5	5,5	10	10	15	15
			660 V	kW	-	-	-	10	-	13
AC 3	Direct-on-line starting	3 phase 3 pole	220 V	kW	1,5	1,5	3	3	4	4
			380/440 V	kW	2,2	2,2	5,5	5,5	7,5	7,5
			500 V	kW	3	3	5,5	5,5	7,5	7,5
			660 V	kW	-	-	-	5,5	-	7,5
		1 phase 2 pole	110 V	kW	0,3	0,3	0,6	0,6	1,5	1,5
			220 V	kW	0,55	0,55	2,2	2,2	3	3
			380/440 V	kW	0,75	0,75	3	3	3,7	3,7
AC 4	Direct-on-line starting, reversing, plugging and inching	3 phase 3 pole	220 V	kW	0,37	0,37	0,55	0,55	1,5	1,5
			380/415 V	kW	0,55	0,55	1,5	1,5	3	3
			440/500 V	kW	0,55	0,55	1,5	1,5	3	3
			660 V	kW	-	-	-	1,5	-	3
		1 phase 2 pole	110 V	kW	0,15	0,15	0,3	0,3	0,45	0,45
			220 V	kW	0,25	0,25	0,75	0,75	1,1	1,1
			380 V	kW	0,5	0,5	1,5	1,5	2,2	2,2
			440 V	kW	0,5	0,5	1,5	1,5	2,2	2,2
AC 23	Occasional switching of motors or other high inductive loads (selection criterion for main switches)	3 phase 3 pole	220 V	kW	1,8	1,8	3,7	3,7	5,5	5,5
			380/440 V	kW	3	3	7,5	7,5	11	11
			500 V	kW	3,7	3,7	7,5	7,5	11	11
			660 V	kW	-	-	-	7,5	-	11
		1 phase 2 pole	110 V	kW	0,37	0,37	0,75	0,75	1,5	1,5
			220 V	kW	0,75	0,75	2,5	2,5	3	3
			380/440 V	kW	1,1	1,1	3,7	3,7	5,5	5,5
RATINGS		UL/CSA[1]								
	Standard motor load DOL-Rating (similar AC 3)	3 phase 3 pole	120 V	HP	1	1	1,5	1,5	2	2
			240 V	HP	1	1	3	3	5	5
			480 V	HP	-	-	-	5	-	10
			600 V	HP	-	-	-	5	-	10
		1 phase 2 pole	120 V	HP	0,33	0,33	0,5	0,5	1	1
			240 V	HP	0,75	0,75	1	1	2	2
			277 V	HP	0,75	0,75	1	1	3	3
	Heavy motor load-reversing (similar AC 4)	3 phase 3 pole	120 V	HP	0,33	0,33	0,5	0,5	1	1
			240 V	HP	0,75	0,75	1	1	2	2
			480 V	HP	-	-	-	2	-	5
			600 V	HP	-	-	-	2	-	5
MAX. PERMISSIBLE WIRE GAGE										
	stranded wire 2 x			mm^2	1,5	1,5	2,5	2,5	4	4
				AWG	14	14	12	12	10	10
	flexible (with sleeve)			mm^2	1,5 (-)	1,5 (-)	2,5 (2,5)	2,5 (2,5)	4 (2,5)	4 (2,5)
				AWG	16	16	14	14	12	12

DRY CIRCUIT RATINGS CG4-1			Rated voltage 1 V	6 V	12 V	24 V	48 V	60 V	110 V 120 V	220 V 240 V
Rated operational currents	AC 1	A	1	0,6	0,45	0,3	0,22	0,2	0,15	0,1
	DC 1	A	0,75	0,45	0,35	0,22	0,13	0,1	0,05	0,025

1) CG6, CG8, CG16 and CG16B acc. to CSA max. 150 V

0

SECTION O

CONTROL RELAYS

EMAIL RH2B-U SERIES

RH2B-U 110V AC RELAY

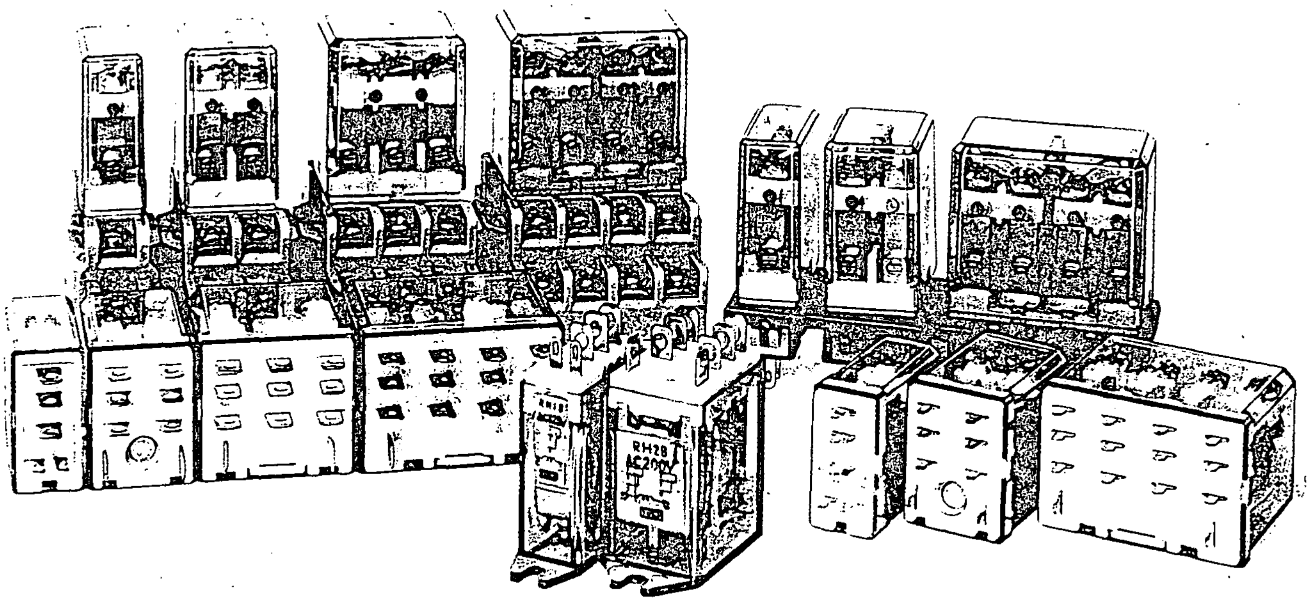
SUPPLIÊD BY EMAIL ELECTRONICS
937 KINGSFORD SMITH DRIVE
EAGLE FARM QLD 4007
TELEPHONE (07) 868 1055
FAX (07) 868 1525

idec YELLOW RELAYS

RH SERIES

RH

Midget Power Type Large Capacity 10A 1-, 2-, 3- and 4-Poles



GENERAL

The IZUMI Yellow Relay RH Series are general purpose power relays with 10A contact capacity, equivalent to RR series relays. As small as IZUMI Miniature Relays, they permit very compact system design and are ideal for installation in small control equipment.
Two types of terminal styles are available: Blade and printed circuit board (2mm wide) types, with 1, 2, 3, or 4 poles. Also available is a top bracket mounting type with blade terminals and 1, 2, or 4 poles.

FEATURES

- **Midget Type Large Capacity Power Relay**
  They have the same capacity as IZUMI Power Relays, with 10A contact rating, 2,000V dielectric strength, but are enclosed in a miniature size relay case.
- **Power Saving**
  Power consumption is as small as IZUMI miniature relays.
- **Simple Construction and High Reliability**
  With simple construction comprising the least number of components possible, these relays are rugged and have high impact resistance.
- **UL Reconginzed and CSA Certified**
- **Complete with Accessories**
  In addition to three different types of sockets, various accessories such as hold-down springs and relay holders are available for convenient relay application.

• **Also available with a mechanical indicator.**

RH SERIES

TYPE LIST

Terminal style	Contact configuration	Basic type	With indicator light	With check button	Top bracket mounting type	With indicator light and check button
B (Blade)	SPDT	RH1B-U	––	––	RH1B-UT	––
	DPDT	RH2B-U	RH2B-UL	RH2B-UC	RH2B-UT	RH2B-ULC
	3PDT	RH3B-U	RH3B-UL	RH3B-UC	––	RH3B-ULC
	4PDT	RH4B-U	RH4B-UL	RH4B-UC	RH4B-UT	RH4B-ULC
V2 (PCB 2-mm wide)	SPDT	RH1V2-U	––	––	––	––
	DPDT	RH2V2-U	RH2V2-UL	RH2V2-UC	––	RH2V2-ULC
	3PDT	RH3V2-U	RH3V2-UL	RH3V2-UC	––	RH3V2-ULC
	4PDT	RH4V2-U	RH4V2-UL	RH4V2-UC	––	RH4V2-ULC

COIL RATINGS

	Rated voltage (V)	Rated current (mA) ±15% at 20°C, 60 Hz SPDT	60 Hz DPDT	60 Hz 3PDT	60 Hz 4PDT	50 Hz SPDT	50 Hz DPDT	50 Hz 3PDT	50 Hz 4PDT	Coil resistance (Ω) ±10% at 20°C SPDT	DPDT	3PDT	4PDT	Maximum continuous applied voltage at 20°C	Minimum pickup voltage at 20°C
AC	6	150	200	280	330	170	238	330	387	18.8	9.61	6.0	5.4	110% of rated voltage without over-heating	80% of rated voltage
	12	75	100	140	165	86	118	165	196	76.8	40.5	25.3	21.2		
	24	37	50	70	83	42	59.7	81	98	300	156.7	103	84.5		
	50	18	24	34	40	20.5	28.3	39.5	47	1,280	706	460	340		
	100	9	12	17	20	10.5	14.2	20	23.5	5,220	3,100	1,940	1,560		
	110	8.4	12	15.5	18.2	9.6	14.2	18.1	21.6	6,950	3,390	2,200	1,800		
	115	7.8	12	14.8	17.5	8.9	14.2	17.1	20.8	7,210	3,510	2,620	1,910		
	120	7.5	11	14.2	16.5	8.6	12.9	16.4	19.5	7,680	4,280	2,770	2,220		
	• 200	–	8	8.5	10	–	9.5	9.8	11.8	–	9,230	8,140	6,360		
	• 220	–	6	7.7	9.1	–	7.1	8.8	10.7	–	13,920	10.800	7,360		
	• 230	–	6	7.4	8.7	–	7.1	8.5	10.3	–	14,410	11,500	8,520		
	• 240	–	5.5	7.1	8.3	–	6.5	8.2	9.8	–	15,720	12,100	9,120		

	Rated voltage (V)	Rated current (mA) SPDT	DPDT	3PDT	4PDT	Coil resistance (Ω) SPDT	DPDT	3PDT	4PDT	Maximum continuous applied voltage at 20°C	Minimum pickup voltage at 20°C
DC	6	128	150	240	250	47	40	25	24	110% of rated voltage without over-heating	80% of rated voltage
	12	64	75	120	125	188	160	100	96		
	24	32	36.9	60	62	750	650	400	388		
	48	18	18.5	30	31	2,660	2,600	1,600	1,550		
	• 100	–	10	14.5	15	–	10,000	6,900	6,670		
	• 110	–	9.1	12.8	15	–	12,100	8,600	7,340		

NOTE: Rated voltages marked with • are not available for SPDT models.

CONTACT RATING

Nominal Rating

Voltage	Resistive SPDT	DPDT	3PDT	4PDT	Inductive SPDT	DPDT	3PDT	4PDT
220V AC	7A	7.5A	7.5A	7.5A	4.5A	5A	5A	5A
110V AC	10A	10A	10A	10A	7A	7.5A	7.5A	7.5A
30V DC	10A	10A	10A	10A	7A	7.5A	7.5A	7.5A

Inductive load: cos ϕ = 0.3, L/R = 7 msec

CSA Rating

Voltage	Resistive SPDT	DPDT	3PDT	4PDT	General use SPDT	DPDT	3PDT	4PDT
240V AC	10A	10A	–	7.5A	7A	7A	7A	5A
120V AC	10A	10A	10A	10A	7.5A	7.5A	–	7.5A
30V DC	10A	10A	10A	10A	7A	7.5A	–	–

Note: Motor Load
1/3 HP for SPDT, DPDT and 3PDT (240V AC)
1/6 HP for SPDT, DPDT and 3PDT (120V AC)

UL Rating

Voltage	Resistive SPDT	DPDT	3PDT	4PDT	General use SPDT	DPDT	3PDT	4PDT	Motor Load SPDT	DPDT	3PDT
240V AC	10A	10A	–	7.5A	7A	7A	*	5A	1/3HP	1/3HP	1/3HP
120V AC	–	–	10A	10A	–	–	–	7.5A	1/6HP	1/6HP	1/6HP
30V DC	10A	10A	10A	–	7A	7A	–	–	–	–	–
28V DC	–	–	–	10A	–	–	–	–	–	–	–

Note: *6.5A/POLE 20A/TOTAL

idec YELLOW RELAYS

RH SERIES

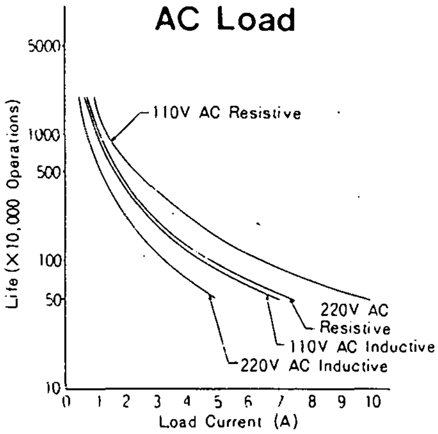
RH

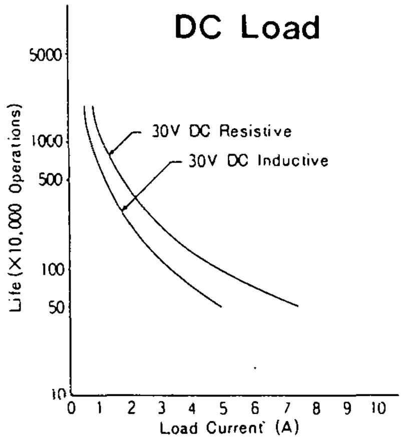
SPECIFICATIONS

Contact material	Silver cadmium oxide (Ag-CdO)
Contact resistance	50 mΩ max. (initial value)
Operate time	SPDT, DPDT (RH1, RH2) ..... 20 msec max. 3PDT, 4PDT (RH3, RH4) ..... 25 msec max.
Release time	SPDT, DPDT (RH1, RH2) ..... 20 msec max. 3PDT, 4PDT (RH3, RH4) ..... 25 msec max.
Power consumption (Approx.)	SPDT (RH1) ...... AC: 1.1 VA (50 Hz), 1 VA (60 Hz) DC: 0.8W DPDT (RH2) .... AC: 1.4 VA (50 Hz), 1.2 VA (60 Hz) DC: 0.9W 3PDT (RH3) .... AC: 2 VA (50 Hz), 1.7 VA (60 Hz) DC: 1.5W 4PDT (RH4) .... AC: 2.5 VA (50 Hz), 2 VA (60 Hz) DC: 1.5W
Insulation resistance	100 MΩ min. (measured with 500V DC megger)
Dielectric strength	SPDT (RH1) Between live and dead parts: 2000V AC, 1 min Between contact circuit and operating coil: 2000V AC, 1 min Between contacts of the same pole 1000V AC, 1 min DPDT, 3PDT, 4PDT (RH2, RH3, RH4) Between live and dead parts: 2000V AC, 1 min Between contact circuit and operating coil: 2000V AC, 1 min Between contact circuits: 1500V AC, 1 min Between contacts of the same pole: 1000V AC, 1 min
Frequency response	1800 operations/hour
Temperature rise	Coil: 85 deg max., Contact: 65 deg max.
Vibration resistance	0 to 6g (55 Hz max.)
Shock resistance	SPDT, DPDT (RH1, RH2) ..... 20 g 3PDT, 4PDT (RH3, RH4) ..... 10 g
Life expectancy	Electrical: Over 500,000 operations (110V AC, 10A)* Mechanical: Over 50,000,000 operations
Ambient temperature	−5 to +40°C
Weight (Approx.)	RH1: 24g, RH2: 37g, RH3: 50g, RH4: 74g

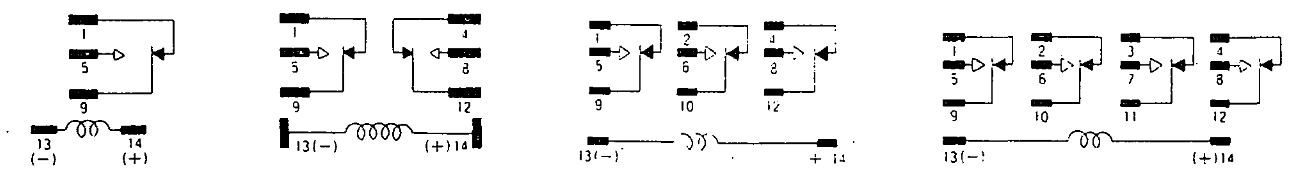
NOTE*: Over 200,000 operations (110V AC, 10A) in SPDT (RH1), 3PDT (RH3) and 4PDT (RH4) types.

ELECTRICAL LIFE (RH2)





CIRCUIT DIAGRAM (BOTTOM VIEW)



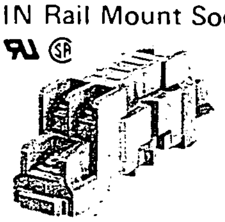
RH1 RH2 RH3 RH4

16

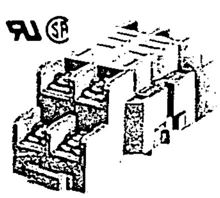
RH SERIES

SOCKET

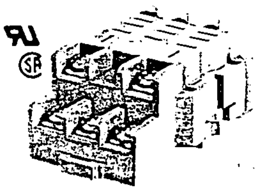
DIN Rail Mount Socket



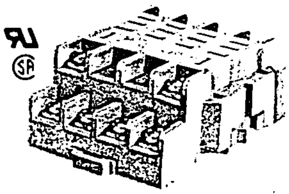
Type SH1B-05U
For RH1B
Weight Approx. 26.5g



Type SH2B-05U
For RH2B
Weight Approx. 42.5g



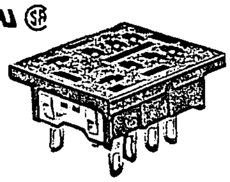
Type SH3B-05U
For RH3B
Weight Approx 59g



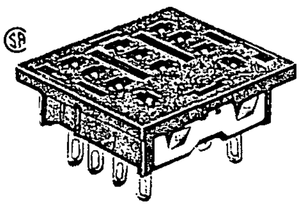
Type SH4B-05U
For RH4B
Weight Approx. 74.5g

Panel Mount Socket

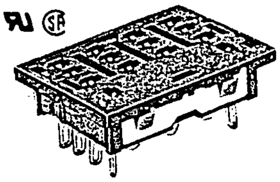
Type SH1B-51
For RH1B
Weight Approx. 6.4g



Type SH2B-51
For RH2B
Weight Approx. 9.7g

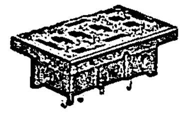


Type SH3B-51
For RH3B
Weight Approx. 14 g

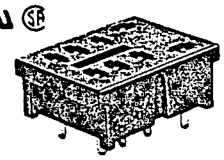


Type SH4B-51
For RH4B
Weight Approx. 17g

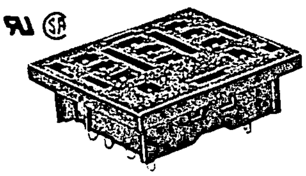
PC Board Mount Socket



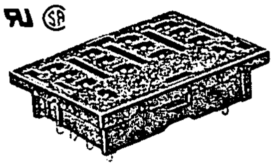
Type SH1B-62
For RH1B
Weight Approx. 5.7g



Type SH2B-62
For RH2B
Weight Approx. 8.2g



Type SH3B-62
For RH3B
Weight Approx. 11 g



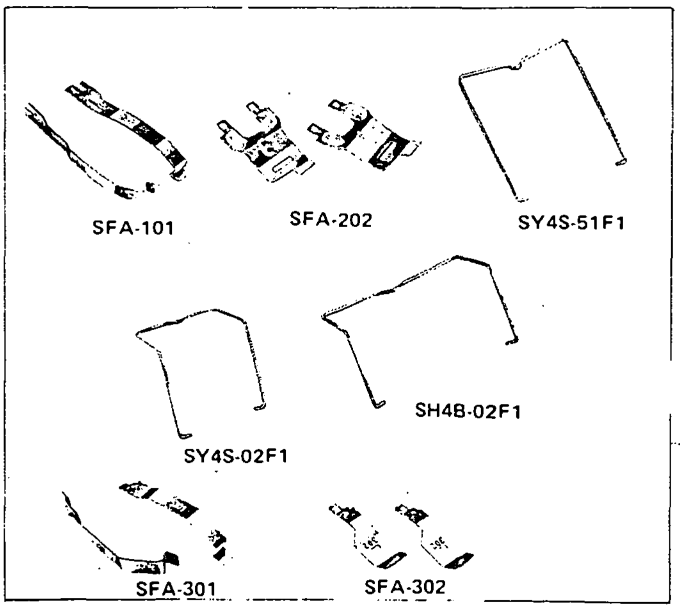
Type SH4B-62
For RH4B
Weight Approx. 16g

NOTE: DIN Rail Mount Sockets can securely snap on 35-mm-wide IZUMI Types BAA,BAP, and BADA DIN Rails, and can also mount on panel surfaces with screws.

HOLD-DOWN SPRING

Type No.	Compatible socket	Compatible relay
SFA-202, SFA-101	SH1B-05U	RH1B
SFA-202, SFA-101	SH2B-05U	RH2B
SFA-101	SH3B-05U	RH3B
SFA-101	SH4B-05U	RH4B
SFA-302, SFA-301 SY4S-51F1	SH1B-51 SH1B-62	RH1B
SFA-302, SFA-301	SH2B-51	RH2B
*SY4S-51F1 (SY4S-02F1)	SH2B-51 SH2B-62	
*SY4S-51F1 (SH3B-05F1)	SH3B-51 SH3B-62	RH3B
*SY4S-51F1 (SH4B-02F1)	SH4B-51 SH4B-62	•RH4B

NOTE: 1 For relays with check button (C type), springs marked with * can not be used, instead springs for DIN rail mount sockets shown in ( ) are applicable, but close mounting is impossible.
2. When an RH4B relay marked with • is mounted on a panel mount socket, use two SY4S-51F1 hold-down springs for each unit.



RH

PQ

SECTION PQ

CONTROL FUSES

GEC RS SERIES

RS20H BLACK FUSE CARRIERS
RS20H WHITE FUSE CARRIES

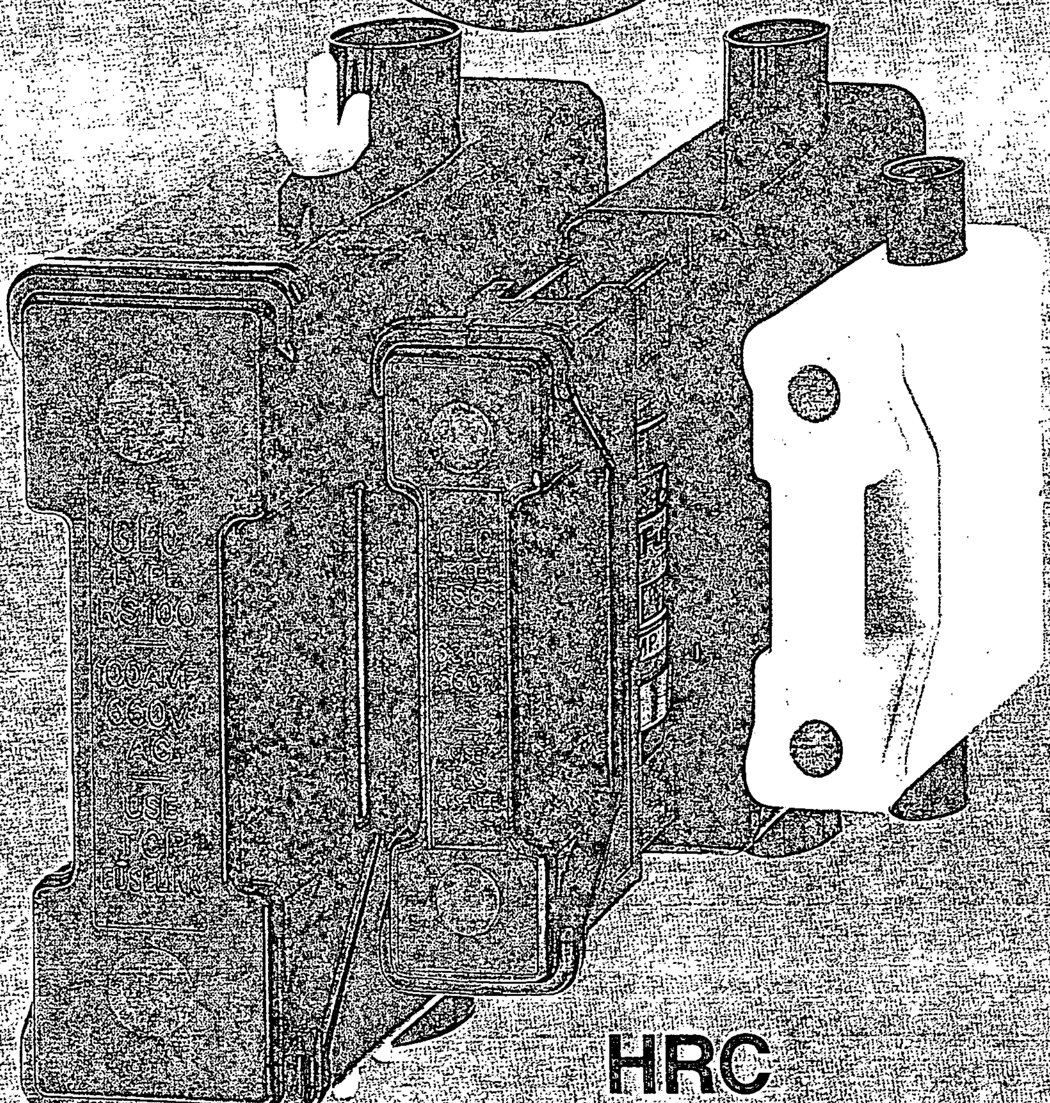
FUSE CARTRIDGES

GEC TYPE T SERIES

NIT 2

SUPPLIED BY G.E.C. AUSTRALIA PTY LTD
663 KINGSFORD SMITH DRIVE
EAGLE FARM QLD 4007
TELEPHONE: (07) 868 1000

REDSPOT



HRC FUSE FITTINGS

GEC ALSTHOM

RED SPOT

Fuse fittings to AS2005.21.2 – 1990 BS88: Part 2: 1988 660 volts A.C./D.C.
Approved by leading Authorities and used in equipment approved by Lloyds.

SAFETY FEATURES

- Full Shrouding for personnel safety and complete compliance with the direct contact electric shock.
- Insulating sleeves are fitted to front connected fuse bases to provide increased protection at the cable entry point.
- Separate base contact insulating shrouds of great strength and flexibility ensure that no 'live' metal is dangerously exposed when the fuse carrier is removed – this enables an outgoing circuit to be cabled with complete safety to personnel and with continuity of supply to other circuits.
- Anti-vibration features protect against release of a fuse-carrier due to vibration in service. In the 400 amp size this includes a safety catch which automatically locks on the insertion of the fuse carrier.

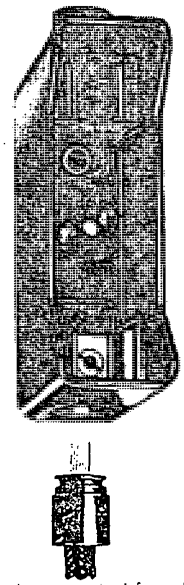


FIG. 1 Front connected fuse base with terminal shroud removed for cabling.

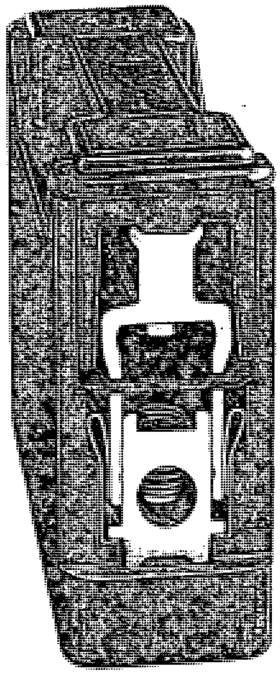


FIG. 2 Cut-away view of 63 amp front connected contact assembly.

RED SPOT SPECIAL FEATURES

20, 32, 63 & 100 amp fuse fittings

Perfect alignment of contacts with single-screw fixing achieved by registration on facets in moulding.

Large contact area and anti-vibration feature incorporated in brass contacts of accurate dimensions.

Tapered shank of fuse link fixing screw ensures easy re-entry.

Safety shroud (cut-away to show base contact) made from moulded red nylon of great strength and flexibility.

Patented non-twist cable clamping screw of large diameter.

Lasting contact pressure ensured by backing stirrups which are located by the shape of the base contact and the moulding.

Carrier and base moulded from flame retardant, non-hygroscopic phenolic.

APPLICATION DATA

RED SPOT

200 & 400 amp fuse fittings

High quality mouldings, safety shrouds and precision made copper contacts ensure reliable operation.

Additional special features

- Through grip handle for maximum control.
- Silver plated contacts with generous cross section.
- Guides to ensure parallel action on insertion or withdrawal of fuse carrier.
- Patented non-twist cable clamping screws of large diameter on the 200 amp and cable clamping plate on the 400 amp fuse holders prevent damage to cables.
- Terminal screw locking device, incorporating the principle used in the twelve sided spanner, can be fitted to the hexagon head of the terminal screw, whatever its position when fully tightened, by using one of the two positions provided for locating the captive screw (arrowed in FIG. 3)

FIG. 3

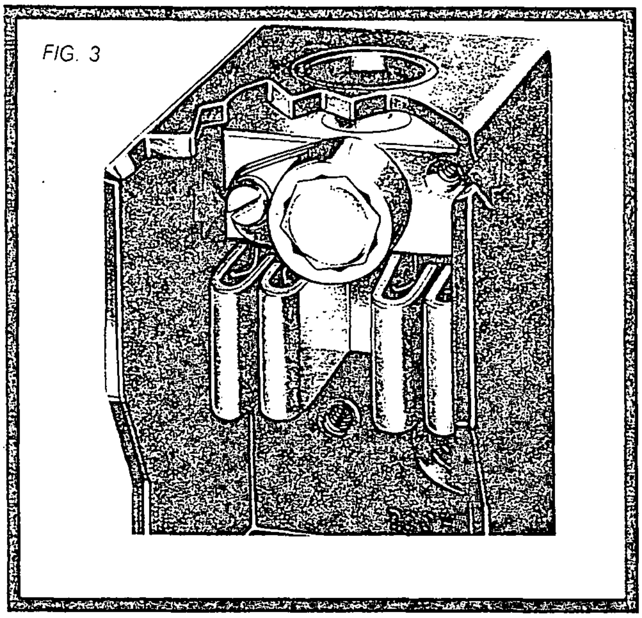


FIG. 4

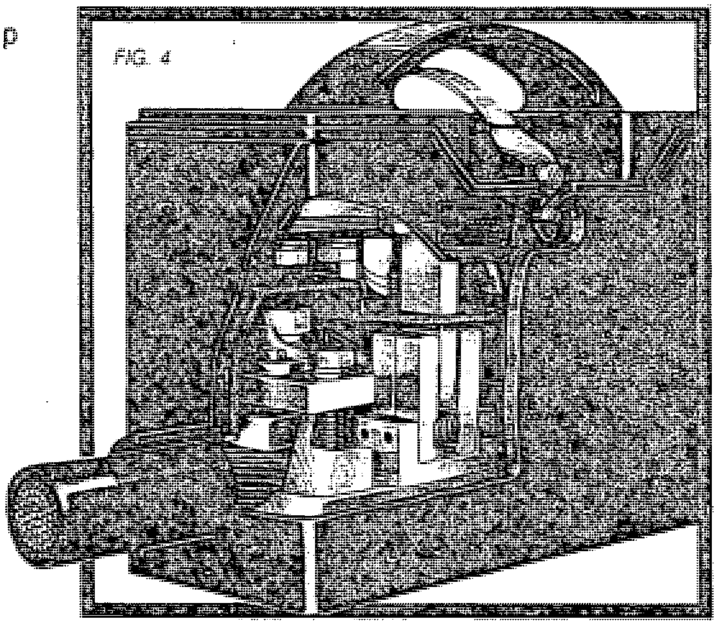


FIG. 3 Front connected 200 amp RED SPOT fuse base with shroud removed and with moulding partly cut-away to show silver-plated base contact and terminal screw locking device.

FIG. 4 Front connected 400 amp RED SPOT fuse fitting with moulding partly cut-away to show silver-plated contact, red nylon shroud and cable clamping device.

LIST NUMBERS

for ordering purposes

Standard Colours: Black & White (RS20 – RS100)

Rating amp	Alternative type of connection			
	FRONT	BACK	FRONT/BACK	BACK WIRED
20	RS20H *	RS20P	RS20PH	RS20BW
32	RS32H	RS32P	RS32PH	RS32BW
63	RS63H	RS63P	RS63PH	RS63BW
100	RS100H †	RS100P	RS100PH	RS100BW †
200	RS200H	RS200P	RS200PH	
400	RS400H	RS400P	RS400PH	

† Available with sealed terminal shrouds. List Nos: RS100H-S, RS100BW-S * For Din Rail Mounting order DIN Rail Adaptor Part No: 588-9020-010.

Illustrations & dimensions shown on pages 5, 6, 7 & 8

APPLICATION DATA

H.R.C. FUSE LINKS ACCOMMODATED				
Fuse fitting rating amp	Type 'T' to BS.88:Part 2 & AS2005.21.2	Extended range of Type 'T' to BS.88:Part 2: & AS2005.21.2 for motor circuit protection. (660 volts a.c.)		
		List No.	Current rating amp	Rating for motor starting amp
20	NIT2-20A (550 volts a.c.)	NIT20M25 NIT20M32 (415 volts a.c)	20 20	25 32
32	TIA2-32A	TIA32M35 TIA32M40 TIA32M50 TIA32M63	32 32 32 32	35 40 50 63
63	TIA2-32A TIS35-63A	TIS63M80 TIS63M100	63 63	80 100
100	TIA2-32A † TIS35-63A † TCP80 & 100A	TCP100M125 TCP100M160 TCP100M200	100 100 100	125 160 200
200	TBC2-63A TC80 & 100A TF125-200A	TF200M250 TF200M315 *	200 200	250 315
400	TBC2-63A § TC80 & 100 § TF125-200 § TKF250 & 315 § TKM250 & 315A TM355 & 400A	TM400M450	400	450

† Adaptor plate required Type 'A' 5BB9306-010
§ Adaptor plate required Type 'B' 5BB9307-010
* 550 volts a.c.

Note: For full details on Type 'T' fuse links, including D.C. performance, please refer to Publication IEF/401 or PSP0000

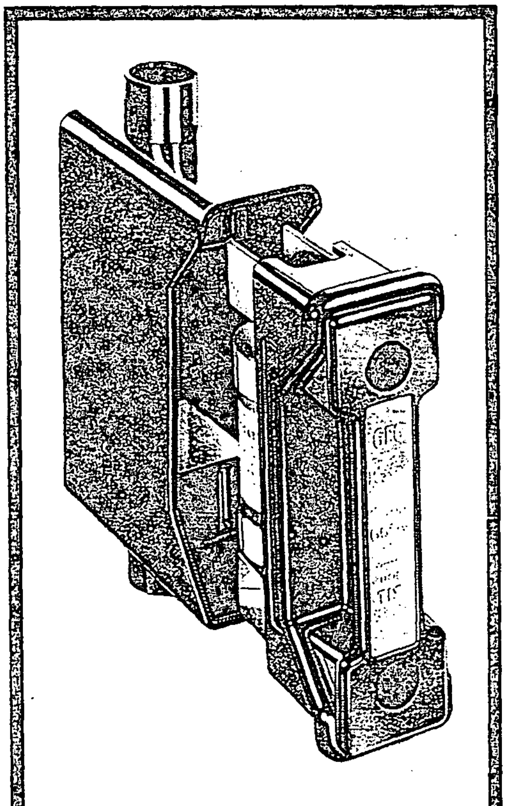


FIG. 5 Front connected 63 amp fuse fitting

METHOD OF CABLING

Front connected fuse fittings

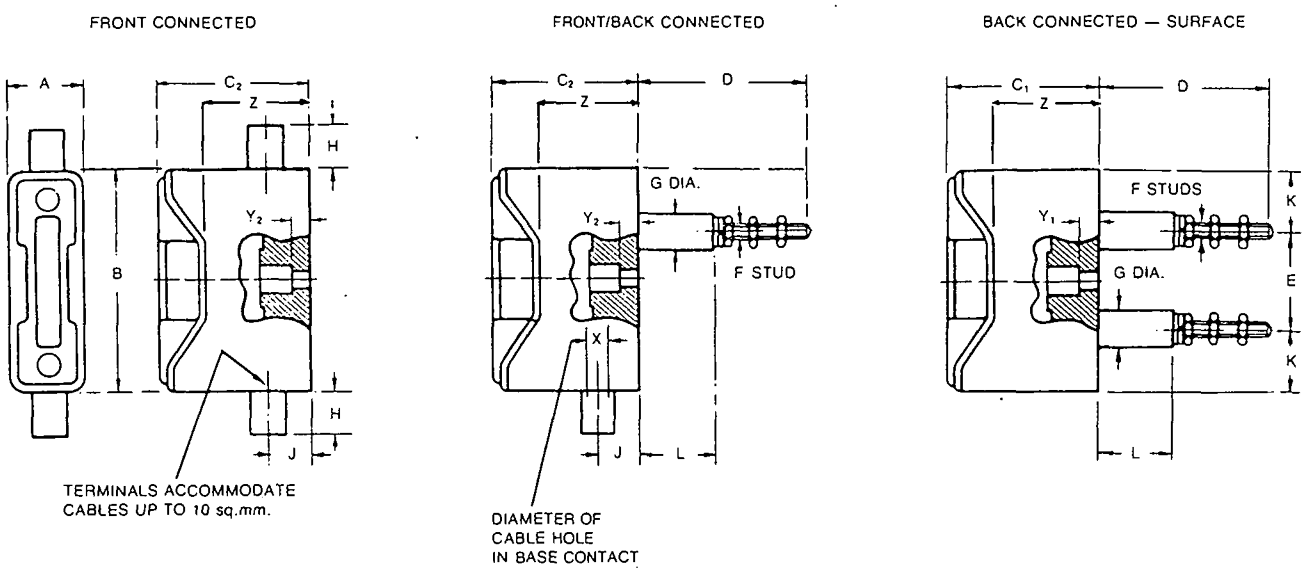
1) Remove red nylon insulating shroud to release cable sleeve.
2) Remove cable sleeve.
3) Fit cable sleeve over cable.
4) Fit conductor into fuse base terminal and tighten cable clamping screw to secure. If flexible cables are used, their relatively fine strands may be given increased protection by the use of thin wall copper ferrules over the conductor ends. The following should be taken into account:
   a) The inside diameter of the thin wall copper ferrule should match that of the bared conductor end as closely as possible.
   b) The length of the thin wall copper ferrule should match that of the tunnel in the fuse base terminal.
   c) The wall thickness of the ferrule should be thin enough for the ferrule to be compressed by the tightening of the cable clamping screw. The flexible conductors will then be consolidated within the deformed ferrule.
5) Replace red nylon shroud taking care that it holds the cable sleeve in position by locating the shroud in the groove provided in the sleeves.

RS100 H-S & RS100 BW-S (COUNCIL SEALABLE)

6) Fit nylon screw through the red nylon shroud with the heads of the screws against the shrouds. Fasten the wingnuts on to the fuse fitting base.

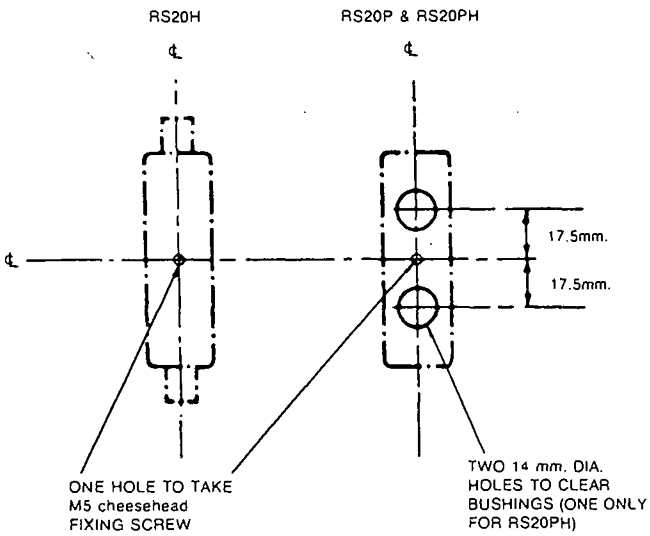
DIMENSIONS

20 amp RED SPOT Fuse Fittings



	A	B	C_1	C_2	D	E	F	G	H	J	K	L	X	Y	Y_2	Z
mm	27.0	79.0	54.0	55.0	63	35	M6	13.5	15.0	16	22.0	29	6.0	5.6	6.6	37

PANEL DRILLING DIMENSIONS
Viewed From Front Of Panel

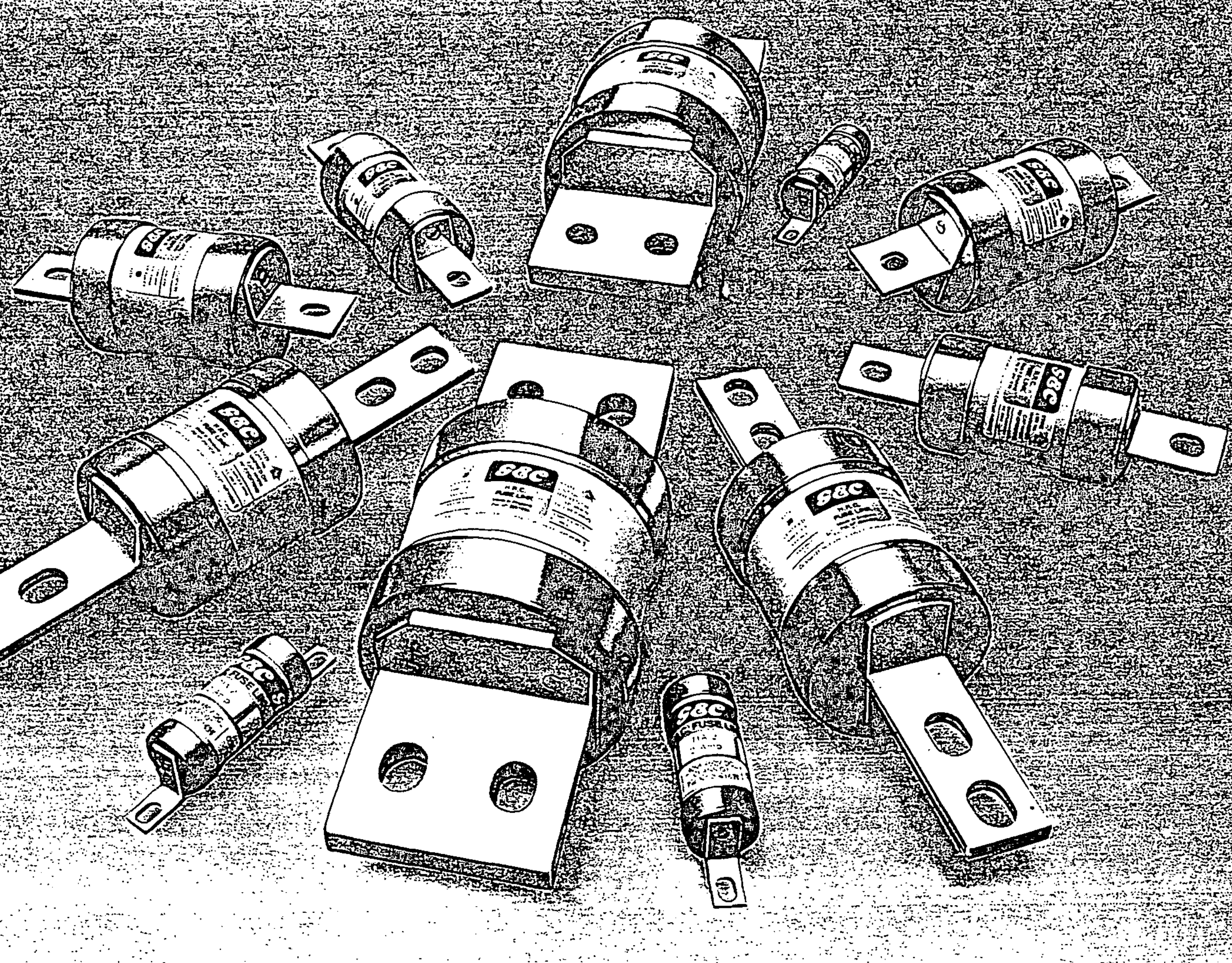


REVISED ISSUE TO 88: Part 2: 1988

GEC

PUBLICATION
IEF/401E
DECEMBER 1988
Supersedes
IEF/401D

TYPE 'T' HRC FUSE LINKS



GEC INSTALLATION EQUIPMENT LTD

Type	Ratings Amp	Utilisation category*	BS88-2 Dimension reference	Maximum voltage rating AC	DC
NIT	2-20	gG	A1	550	250
NIT	20M25, 20M32	gM	A1	415	–
TIA	2-32	gG	A2	660	460
TIA	32M35-32M63	gM	A2	660	460
TIS	35-63	gG	A3	660	460
TIS	3M80, 63M100	gM	A3	660	–
TCP	80, 100	gG	A4	660	460
TCP	100M125-100M200	gM	A4	660	350
TFP	125-200	gG	–	660	350
TB	2-63	gG	–	660	460
TBC	2-63	gG	–	660	460
TC	80, 100	gG	B1	660	460
TC	100M125-100M200	gM	B1	660	350
TF‡	125-200	gG	B2	660	350
TF	200M250	gM	B2	660	460
TF	200M315	gM	B2	550	–
TKF	250, 315	gG	B3	660	460
TKF	315M355	gM	B3	660	460
TKM	250, 315	gG	–	660	460
TMF	355, 400	gG	B4	660	460
TMF	400M450	gM	B4	660	460
TM	355, 400	gG	C1	660	460
TM	400M450	gM	C1	660	460
TMT	355, 400	gG	–	660	460
TTM	450-630	gG	C2	660	450
TTM	630M670	gM	C2	660	450
TT	450-630	gG	–	660	450
TLM‡	670-800	gG	C3	660	350
TLT	670-800	gG	–	660	350
TLU	560-800	gG	–	660	350
TXU	1000, 1250	gG	D1	660	300

** See page 8*

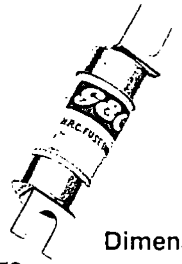
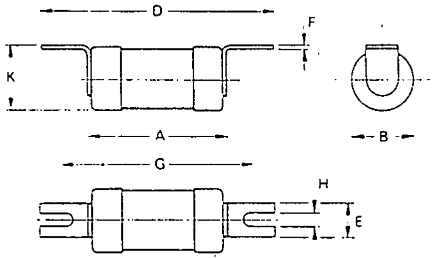
‡ Type TZF and TZLM fuse links proved at 460V DC are available for users who need superior DC performance in these dimensional references.

Notes

1) *Non-standard tag arrangements available – Details on request.*
2) *A 1600 Amp Type TUV1600 fuse link is also available. This is outside the scope of the specification. Details on request.*

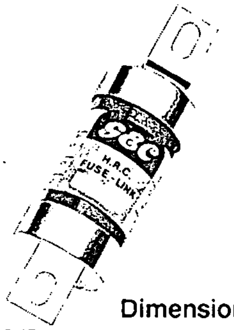
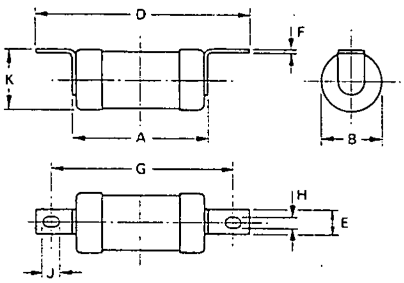
'ASTA20 Certified' endorsement on a low voltage fuse link indicates that the design has been proved and Certified by ASTA to the relevant B.S. and that the fuse links are examined periodically under the ASTA surveillance scheme.

Off-set tags 2-hole fixing

Type	Rating Amp	List numbers	A	B	D	E	F	G Fixing centres	H	K
NIT **2-20A** *Extended Motor Range 20M25 & 20M32†*	2	NIT2	36·50	13·90	55·60	11·10	0·80	44·50	4·70	14·30
	4	NIT4	BS88: 1988 Dimensional Ref. **A1**							
	6	NIT6								
	10	NIT10								
	16	NIT16								
	20	NIT20								
	20M25	NIT20M25†								
	20M32	NIT20M32†								

Off-set tags 2-hole fixing

Type	Rating Amp	List numbers	A	B	D	E	F	G Fixing centres	H	J	K
TIA **2-32A** *Extended Motor Range 32M35–32M63†*	2	TIA2	56·40	23·80	85·80	8·70	1·20	73·00	5·20	7·10	23·80
	4	TIA4	BS88: 1988 Dimensional Ref. **A2**								
	6	TIA6									
	10	TIA10									
	16	TIA16									
	20	TIA20									
	25	TIA25									
	32	TIA32									
	32M35	TIA32M35†									
	32M40	TIA32M40†									
	32M50	TIA32M50†									
	32M63	TIA32M63†									
TIS **35-63A** *Extended Motor Range 63M80–63M100†*	35	TIS35	56·40	23·80	85·80	8·70	1·20	73·00	5·20	7·10	23·80
	40	TIS40	†58·00	26·20	90·50	12·70	1·20	73·00	5·20	—	27·80
	50	TIS50	BS88: 1988 Dimensional Ref. **A3**								
	63	TIS63									
	63M80	TIS63M80†									
	63M100	TIS63M100†									
TCP **80 & 100A** *Extended Motor Range 100M125–100M200†*	80	TCP80	70·00	34·90	111·00	19·10	2·40	93·70	8·70	10·30	34·90
	100	TCP100	BS88: 1988 Dimensional Ref. **A4**								
	100M125	TCP100M125†									
	100M160	TCP100M160†									
	100M200	TPC100M200†									
TFP **125-200A**	125	TFP125	70·00	34·90	111·00	19·10	2·40	93·70	8·70	10·30	34·90
	160	TFP160									
	200	TFP200									

† *Fuse links from the Extended Range for Motor Circuits – See Pages 8 & 13*

Circuit loading

The HRC fuse link selected for any circuit should have a continuous current rating not less than the full load current of the circuit.

Complete cable protection

A standard rating of type 'T' fuse link (classified as type 'gG' to BS88:Part 1:1988, and marked accordingly) will protect an associated pvc insulated cable against both overload and short circuit if its current rating (I_n) is equal to, or less than, the current rating of the cable (I_z). This is in accordance with rule 433-2 of 15th Edition, IEE Wiring Regulations for Electrical Installations.

Protection of cables against short circuit faults

In some circuits (eg, motor circuits) it is not economical practice to match fuse link and cable ratings to provide complete cable protection in the manner described above, because the circuits produce significant overcurrents during switching. In such cases the fuse links are chosen to withstand the transient conditions, and provide only short circuit protection to the associated cables and other circuit components, the necessary overload protection then being provided by other means. In a motor circuit, for example, the contactor and its overload relays afford overload protection to motor windings and cable, and the fuse links are chosen to protect all the circuit components against damage when a short circuit fault occurs (see section on motor circuit protection on page 12).

Conductor cross sectional area	Maximum current carrying capacity		Maximum current rating of Type 'T' fuse link that can be used with this conductor †
	'Open' conditions Ratings as Column 7 of IEE Table 9DI Method 1 – 3 or 4 single core cables in 'clipped direct' conditions	'Enclosed' conditions Ratings as Column 5 of IEE Table 9DI Method 3 – 3 or 4 single core cables in 'enclosed' conditions	
mm²	Amp	Amp	Amp
1	14	12	20*
1·5	18	15·5	25
2·5	25	21	35
4	33	28	50
6	43	36	63
10	59	50	100
16	79	68	160
25	104	89	200
35	129	110	315
50	167	134	355
70	214	171	500
95	261	207	630
120	303	239	750

The short circuit protection of cables is covered by rule 434-6 of the IEE Wiring Regulations, and the table shows how type 'T' fuse links relate to this rule in protecting pvc insulated copper conductors.

Notes

The formula given in rule 434-6 is : $I^2t = k^2S^2$
Where
I = current which causes fuse to operate in 5 seconds
t = 5 seconds
k = 115, the constant for pvc insulated copper conductors, when cables run at maximum current carrying capacity
S = conductor cross sectional area in mm²

* *1mm² cable to be run continuously at not more than 6·5A when used with 20A fuse link rating.*

† *Where a fuse link from the extended range of motor circuit fuse links is used (ie. one classified and marked 'gM') the larger of its dual current ratings is applicable. eg. a TCP100M160 can be used with a 16mm² conductor.*

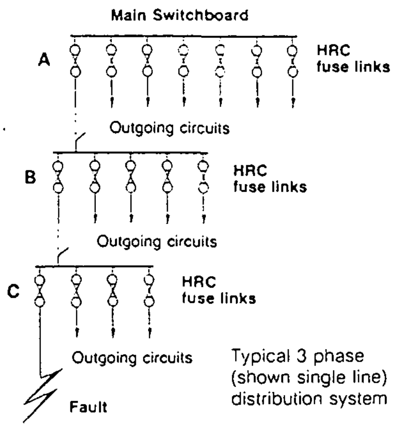
Short circuit energy limitation

Type 'T' fuse links limit the peak current and energy let through to circuits which experience major short circuit faults. This limitation is so great that equipment manufacturers exploit it to produce economic designs which, when used in combination with type 'T' fuse links, can withstand very high fault levels.

Such users have to prove their equipment under the worst possible conditions (ie. at maximum breaking capacity, at 110% rated voltage, very low power factor, and with faults initiated at the most onerous points on the voltage wave), and they require relevant data from the fuse link manufacturer. For type 'T' fuse links this is given in the form of the cut-off current and I^2t characteristics shown on pages 14 to 19 inclusive.

Discrimination between fuse links

In service, the short circuit fault conditions encountered are usually less exacting than those produced in proving tests on fuse links and associated equipment. BS88:Part 1: 1988 states that fuse links experience fault currents which produce pre-arcing times longer than 0·01 second in most cases, and on that basis fuse links complying with the standard are deemed to discriminate with each other when the ratio between the current ratings of 'major' and 'minor' fuse links is 1·6:1 (see Figure 1).



Typical 3 phase (shown single line) distribution system

With properly selected GEC HRC fuse links 'minor' fuse link 'C' operates and 'major' fuse links A & B remain unaffected

Fig 1

Whilst the BS88 statement is reasonable in relation to 240V applications fault currents in major installations can be much greater. However, even in the latter cases conditions are less onerous than those encountered in test stations (in particular, the circuits are usually three phase with relatively high power factors).

In practice therefore, the I^2t values of type 'T' fuse links are significantly less than the ones listed on pages 14-17, and they will discriminate with each other at fault levels up to 80kA, 415V, if the relationship between 'major' and 'minor' ratings is as given in the table. In most cases the discrimination ratio is 1·6:1, or less, and this provides economic benefits in modern installations. Tests have been taken to prove this level of performance.

The table also gives details of combinations which will discriminate at 550V and 660V.

'Minor' fuse link rating	Minimum rating (Amp) of 'Major' fuse link that will discriminate with the 'minor' fuse link at the voltage shown at prospective currents up to 80kA		
Amp	415V	550V	660V
800	1250	–	–
750	1250	1250	–
710	1250	1250	1250
670	1250	1250	1250
630	1000	1250	1250
560	800	800	1000
500	750	800	1000
450	670	750	800
400	630	670	750
355	630	630	670
315	500	500	630
250	400	450	500
200	315	400	400
160	250	315	315
125	200	200	250
100	160	200	200
80	125	160	160
63	100	160	160
50	80	100	125
40	63	63	100
35	50	63	80
32	40	50	63
25	40	40	40
20	32	32	35
16	25	25	32

Protection against electric shock

To provide an adequate degree of protection against electric shock in a final circuit. Section 413 of the 15th Edition of the IEE Wiring Regulations for Electrical Installations requires a circuit protective device in a fixed installation to interrupt an earth fault current within 5 seconds. Maximum permitted earth loop impedance values (Z_s) are specified for each circuit, the values being dependent on the type of protective device used. Table 41A2(a) of the Regulations specifies values of Z_s when fuse links to BS88:Part 2:1988 are used. These are generally higher than those specified for mcb's, and the superior performance of fuse links in this respect enables economies to be made in the sizes of protective conductor installed.

Z_s = Circuit maximum earth loop impedance.

Type 'T' rating	Earth loop impedance maximum value (Z_s) for circuits supplying fixed equipment
Amp	Ohm
10	7·7
20	3·0
32	1·8
40	1·4
50	1·1
63	0·86
100	0·45
200	0·19
400	0·096
630	0·054
800	0·034

Effect of high ambient air temperatures

In accordance with BS88:Part 1:1988, type 'T' fuse links are suitable for use in ambient air temperatures not exceeding 40°C with a mean value measured over 24 hours of not more than 35°C. At higher temperatures derating may be necessary in some cases.

Type 'T' fuse links rated up to 25A do not need to be derated in ambient * air temperatures up to 65°C, and ratings from 32A to 63A may be used in ambient * air temperatures up to 60°C without derating.

Larger current ratings can also be used in ambient * air temperatures greater than those specified in BS88:Part 1:1988, and the table opposite gives maximum permitted load currents for such ambients.

Note
* *In service, fuse links are almost invariably mounted in enclosures, and the latter are assumed to have inside temperatures 15°C higher than the outside ambient temperature if they comply with relevant British Standards. Such equipment will be derated in accordance with the known outside ambient air temperature (row A of the table). If the enclosure is non standard and/or mounted in a particularly harsh environment, it is necessary to de-rate the fuse link in accordance with the expected temperature inside the enclosure (row B of the table).*

Nominal fuse rating	Maximum load current at these * ambient air temperatures (°C)				
	A				
	40°	45°	50°	55°	60°
	B				
Amp	55°	60°	65°	70°	75°
80	Fuse links can be fully rated			75	70
100				95	90
125				120	110
160				145	135
200			190	180	170
250			235	225	210
315		300	285	270	255
355		350	330	315	295
400		400	380	360	340
450		425	405	380	360
500	475	450	425	400	380
560	540	520	495	465	440
630	600	570	540	510	480
670	650	615	585	550	520
710	700	665	630	595	560
750	750	710	670	630	590
800	760	720	680	640	600
1000	950	900	850	800	750
1250	1140	1070	1020	960	900

Capacitor circuits

Three phase power factor correction capacitors can be protected against case rupture, and their associated cables and equipment protected against damage, by Type 'T' fuse links in the event of a capacitor failure. A fuse link with a current rating not less than 1·5 times rated capacitor current will be needed to withstand the associated switching transient currents and circuit harmonics.

Please consult GEC Installation Equipment Ltd, for advice on applications not covered in this publication.

All type 'T' fuse links have excellent ability to protect motor circuits. When selected in the manner shown below, they not only withstand motor starting surges and full load currents without deteriorating, but also provide superior short circuit protection to associated motor starter components.

Leading manufacturers of motor starters can offer ASTA certified type 'c' co-ordination to Appendix C of BS4941:1979 (IEC292-1) by using type 'T' fuse links in combination with their chosen contactors and overload relays. Please consult GEC Installation Equipment for further information on this subject.

Selecting HRC fuse links to protect 3-phase induction motor circuits

1 Table 1 opposite, gives motor full load currents at various system voltages. In the absence of specific information obtain the motor FLC from this table.

2 The motors are assumed to produce the starting conditions shown in Table 2.

3 Choose the recommended fuse link for the motor FLC and starting condition from Table 3 (D.O.L. start) or Table 4 (assisted start).

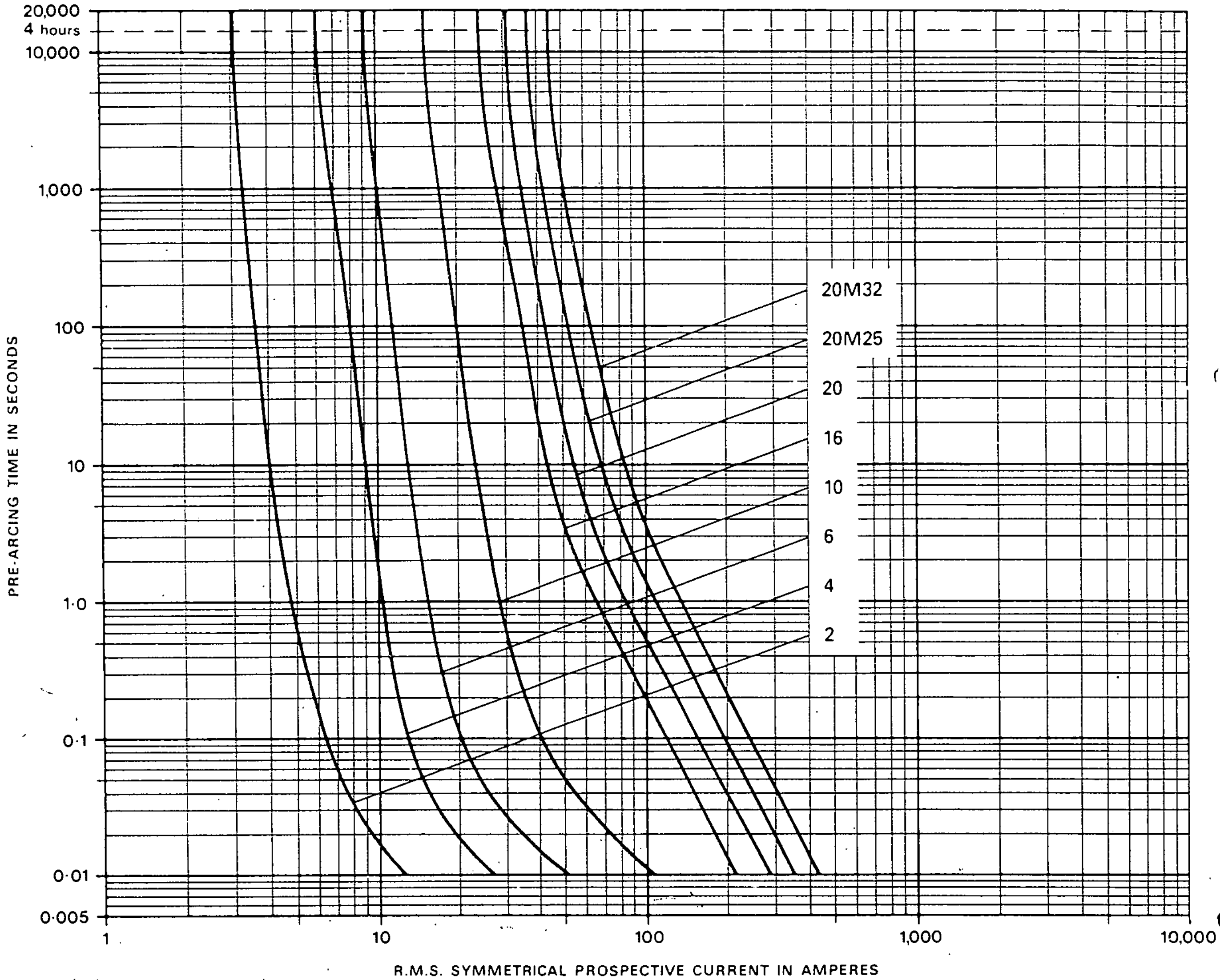
Table 1 Full load currents of typical 3-phase induction motors at voltages shown

Motor rating							
kW	HP	220V	380V	415V	440V	550V	660V
0·37	0·5	2·0	1·15	1·05	1·0	0·8	0·7
0·55	0·75	2·7	1·6	1·5	1·4	1·1	0·9
0·75	1	3·9	2·3	2·0	1·9	1·5	1·3
1·1	1·5	4·7	2·8	2·5	2·4	1·9	1·6
1·5	2	6·5	3·8	3·5	3·3	2·6	2·2
2·2	3	9·3	5·4	5·0	4·7	3·8	3·2
3	4	12	7·1	6·5	6·1	4·9	4·1
4	5·5	15·4	9·0	8·4	7·9	6·4	5·3
5·5	7·5	20·7	11·9	11	10·3	8·2	6·9
7·5	10	28	16·1	14·4	14	11·2	9·3
11	15	39·1	23	21	19·8	15·8	13·2
15	20	52·8	30·5	28	26·4	21·1	17·6
18·5	25	66	38	35	33	26·4	22
22	30	77	45	41	39	31	26
30	40	103	60	55	52	42	35
37	50	128	75	69	65	52	43·3
45	60	151	87	80	75	60	50
55	75	185	107	98	92	74	62
75	100	257	148	136	128	102	85
90	120	308	180	164	154	123	102
110	150	370	214	196	185	148	123
132	175	426	247	226	213	170	142
150	200	500	292	268	252	202	168
160	215	–	300	275	260	207	173
200	270	–	391	358	338	270	225
240	320	–	467	428	404	323	269
280	375	–	533	488	460	368	307
300	400	–	573	525	495	396	330
320	425	–	587	538	507	406	338

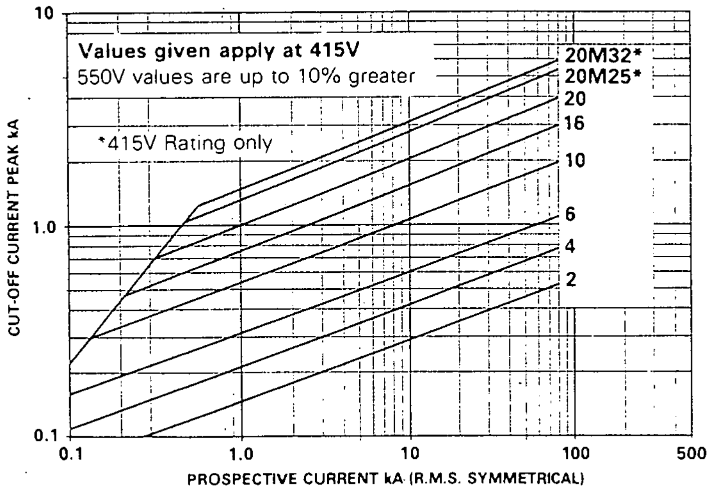
Table 2 Assumed starting conditions

Motor rating	Direct-on-line starting conditions	Assisted start conditions
Up to 1kW	5 x FLC for 5 secs	2·5 x FLC for 20 secs
1·1 to 7·5kW	6 x FLC for 10 secs	3·5 x FLC for 20 secs
7·6 to 75kW	7 x FLC for 10 secs	
Greater than 75kW	6 x FLC for 15 secs	

Type NIT Time Current Characteristics (including gM ratings)



Type NIT Cut-off Current Characteristics



Type NIT I²t Values

Current rating	Pre-Arcing I^2t (A^2sec)	Total I^2t (A^2sec) at:	
Amp		415V	550V
2	2·2	5·4	31
4	7·2	18	70
6	21	60	400
10	100	280	1000
16	300	850	2000
20	540	1000	2500
20M25	900	3000	—
20M32	1100	4000	—

R

SECTION R

CONTROL TERMINALS

KLIPPON SAK 4 SERIES

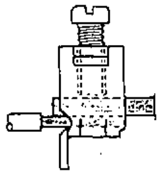
SUPPLIED BY: QED PTY LTD
9 HARVETON STREET
STAFFORD QLD 4053
TELEPHONE: (07) 352 5399

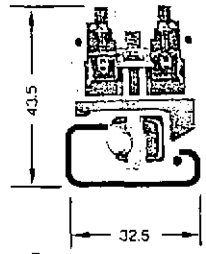
Feed-through Terminals Type SAK

Screw Clamp Connections

SAKD 2.5N

500V 20A





Thickness 5mm

The SAK Series of feed-through terminal blocks are employed for the connection of various conductor sizes. The bare conductor is inserted directly into the yoke with no further preparation, and the tightening of the screw effects a vibration proof connection.

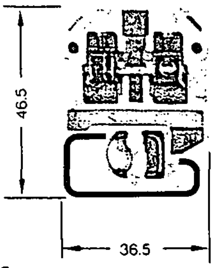
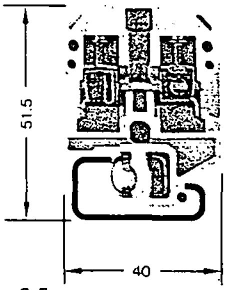
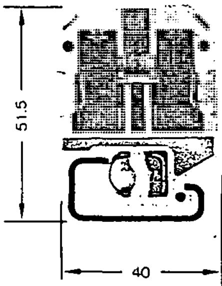
Most terminal types are available in either melamine moulding material or polyamide 6.6 and are designed to be mounted directly on assembly rail TS32 to EN50035. (BS5825)

Cross connection can be achieved using standard QL2-QL10 jumper bars fitted in the centre of each terminal block. Switchable connections can be achieved using the switchable link VL2.

For additional safety covers type AD may be fitted with a plastic screw on top of the ninal block.

Technical Data			
Conductor size	Solid (mm²)	0.22–2.5	
	Stranded (mm²)	0.22–2.5	
Insulation stripping length	(mm)	9	
Ordering Data			**Cat. No.**
Moulding material	Polyamide		021556
When ordering EEx'e' and Ex'N'	Polyamide		021558
terminals, add suffix 'e' or 'N' to the	Melamine		
catalogue number	Melamine		
Approvals			
All Approvals are listed		BASEEFA-Ex CEGB	
in Approvals Guide			
Terminal Rail (2m)		**Type**	**Cat. No.**
	Steel	TS32	012280
	Steel (M6 Slots)	TS32	067610
Locking pin (1m) — optional	Steel	SST3	015270
End Bracket (thickness mm)			
		EWK1 (8.5)	020616
End Plate (thickness mm)			
	Polyamide	AP (1.5)	015096
	Polyamide	AP (1.5)	015098
	Melamine		
	Melamine		
Partition (thickness mm)			
	Polyamide	TW (0.5)	019186
	Polyamide	TW (0.5)	019188
	Melamine		
	Melamine		
	Resin bonded paper	TW (0.5)	030750
Small partition	Polyamide	TSch 3	036686
Cross Connections			
Q unit (See Section T6)	2 way	QL 2	021580
	3 way	QL 3	021590
	4 way	QL 4	021600
	10 way	QL 10	033800
	Sleeve	VH 8.5	026690
	Screw	BS (M2.5 x 14)	036770
	Washer	Captive on Screw	
	Bi-pole plug		
Switching Link			
	2 way		
	Sleeve		
	Screw		
	Washer		
Test Plug			
	Plug	PS (2.3Ø)	018040
	Plug bolt	StB 8.5	021570
Warning Label			
	Label		
	Plastic screw		
Cover (1m)			
	Transparent cover	ADP 1	048520
	Support bracket	HP 1	048556
Marking Tags			
All marking systems are shown in Section T6		DEKAFIX — SECTION T6	

For additional accessories see Section T6

SAK 2.5		SAK 4		SAK 6N	
750V 27A		750V 36A		750V 47A	
					
Thickness 6mm		Thickness 6.5mm		Thickness 8mm	
0.5–4		0.5–6		0.5–10	
0.5–4		0.5–4		0.5–6	
9		12		12	
	Cat. No.		Cat. No.		Cat. No.
	027966		012836		019326
	027968		012838		019328
	027962		012832		019322
	027967		012837		019327
BASEEFA–Ex CEGB Ⓝ Ⓓ		BASEEFA–Ex CEGB Ⓝ Ⓓ		BASEEFA–Ex CEGB Ⓝ Ⓓ	
Type	Cat. No.	Type	Cat. No.	Type	Cat. No.
TS32	012280	TS32	012280	TS32	012280
TS32	067610	TS32	067610	TS32	067610
SST 3	015270	SST 3	015270	SST 3	015270
EWK 1 (8.5)	020616	EWK 1 (8.5)	020616	EWK 1 (8.5)	020616
1.5)	027956	AP (1.5)	011796	AP (1.5)	011796
1.5)	027958	AP (1.5)	011798	AP (1.5)	011798
AP (1.5)	027952	AP (1.5)	011792	AP (1.5)	011792
AP (1.5)	027957	AP (1.5)	011797	AP (1.5)	011797
TW (1.5)	030286	TW (1.5)	013016	TW (1.5)	013016
TW (1.5)	030288	TW (1.5)	013018	TW (1.5)	013018
TW (2.5)	030282	TW (2.5)	013012	TW (2.5)	013012
		TW (2.5)	013017	TW (2.5)	013017
TW (1.0)	029710	TW (0.5)	019710	TW (0.5)	019710
QL 2	015590	QL 2	013060	QL 2	019430
QL 3	015600	QL 3	013070	QL 3	019440
QL 4	015610	QL 4	013080	QL 4	019450
QL 10	033810	QL 10	033820	QL 10	033830
VH 8	026670	VH 13.5	024850	VH 12	024900
BS (M3 x 15)	035900	BS (M3 x 20)	030300	BS (M3 x 20)	030300
Captive on screw		Captive on screw		Captive on screw	
DQS2 (See Section T6)		QS2	021270	QS2	027096
		VL 2	019700	VL 2	019700
		VH 19	028510	VH 19	028510
		BS (M3 x 25)	029250	BS (M3 x 25)	029250
		SS	016440	SS	016440
PS (2.3Ø)	018040	PS (2.3Ø)	018040	PS (4Ø)	029960
StB 8.5	021570	StB 8.5	021570	StB 14	016990
AD 4	037560	AD 4	037610	AD 4	037600
K (M3 x 22)	012890	BSK (M3 x 22)	012890	BSK (M3 x 22)	012890
ADP 1	048520	ADP 2	048530	ADP 2	048530
HP 1	048556	HP 2	048566	HP 2	048566
DEKAFIX — Section T6		DEKAFIX — Section T6		DEKAFIX — Section T6	

S

SECTION S

INDICATING LIGHTS

NHP DT3 SERIES

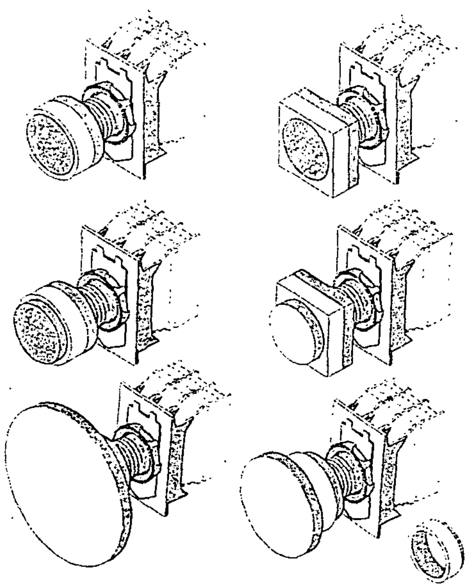
DT3P-GRB PUSH BUTTONS
DN3-40-01 EMERGENCY STOP PUSH BUTTON

SUPPLIED BY: NHP PTY LTD
25 TURBO DRIVE
COORPAROO QLD 4151
TELEPHONE (07) 891 6008
FAX (07) 891 6139

sprecher + schuh

Control & signalling units - DT 3 series
Complete units to specification

Refer catalogue 1803



Pushbuttons

Design (for front mounting)	Cat. No.	Front ring	Colour ring	Inscription cap	Contact block
Pushbutton	DT 3	-	-		
Raised pushbutton [1])	DTH 3	-	-	-	
Latched pushbutton	DTV 3	-	-		
Raised latched pushbutton [1])	DTVH 3	-	-	-	
Mushroom pushbutton [1]) 42mm Ø	DP 3	-	-	-	
Latched mushroom pushbutton 42mm Ø	DPV 3	-	-	-	
Mushroom pushbutton 68mm Ø	DPG 3	-	-	-	
Latched mushroom pushbutton [1]) 68mm Ø	DPGV 3	-	-	-	

Order number suffix

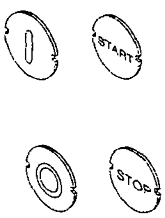
Front ring

Round	PB	Raised PB	Mush.	Front ring
grey plastic	P	P	P	P
black plastic	N	N	N	N
metal	L	L	L	L
metal extended	M	-	-	M
metal sealed	F	-	-	F

Square	Front ring
grey plastic	QP
black plastic	QN

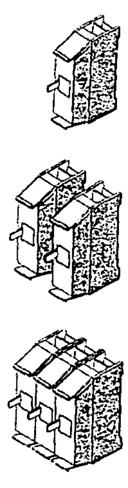
Colour

Colour	PB	Raised PB	Mush. 42	Mush. 68	Colour ring
green	G	G	G	G	G
red	R	R	R	R	R
yellow	Y	Y	Y	-	Y
blue	B	-	-	-	B
white (clear)	W	-	-	-	W



Inscription cap

		Inscription cap
white	blank	101
	I	369
other text and	O	370
symbols [2])	START	166
	STOP	167
black	blank	106



DE 3 Contact blocks [3])

	Contact block
none	00
1 contact block	01
	10
2 contact blocks	02
	11
	20
	1L
3 contact blocks	03
	12
	21
	30
	2L

Notes: [1]) Legend caps cannot be used.
[2]) Legend carriers and legend inserts, refer pages 10 - 23 & 10 - 24.
[3]) Further contact blocks can be fitted at the second level.
Contact blocks for base mounting (separate mounting) refer page 10 - 22.
For operating contact block in centre position, use of operating bridge DT 3-OB is required refer page 10 - 21.

10

Control & signalling units - DT 3 series
Technical information

Refer catalogue 1803

SEV
Switzerland

CSA
Canada

UL Listed
USA

DEMKO
Denmark

NEMKO
Norway

SEMKO
Sweden

Electrical
Inspectorate
Finland

644 CEBEC

CEBEC
Belgium

Germanischer
Lloyd
FRG

Standards

IEC 204-1, 337; SEV 1005, 1093; VDE 0113, 0660 PART 201; BS 4794; CEE 24; CSA 22.2, Number 0, Number 14; UL 508, 486 E

Approvals

SEV, CSA, UL, CEBEC, Germ. Lloyd, DEMKO, NEMKO, SEMKO, Finland, Buro Veritas, USSR Reg. — in preparation

Rated insulation voltage U_i

IEC 337, VDE 0110, insulation group C	660V
CSA, UL	600V

Test voltage

phase-phase	3kV, 1s
phase-earth	4kV, 1s

Life		DT/DP	DS	DTV/DPV	DSS/DN/DNS
mechanical	million operations	10	0.5	0.5	0.05

UL Utilisation category

heavy pilot duty	AC	A 600
light pilot duty	DC	Q 600

Ambient temperature

AC 1, AC 15 operation	-25°C ... +60°C (T 85) (inside and outside the enclosure. For illuminated pushbuttons and switches max. external temperature 40°C)
storage, transport	-40°C ... +80°C

Climatic resistance

damp heat 40°C/ 95% rel. humidity	56 days
humidity cycling 23°C, 83%, 40°C, 93%	20 cycles

Degree of protection

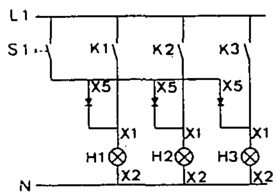
to IEC 529, DIN 40 050	IP 65	except rotary switch with key and emergency stop pushbutton with key (DSS 3, DNS 3)
	IP 54	DSS 3, DNS 3
	IP 20	contact and lamp blocks
Protection against accidental contact to	VDE 0106, part 100	

Shock withstand

to IEC 68-2-27	30 g

Mounting orientation	as required

Note: Example of central lamp test.
For lamp element details refer page 10 - 26.



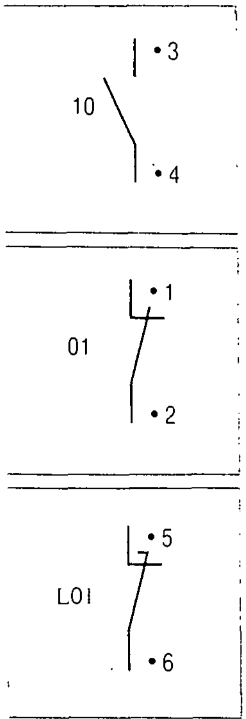
10

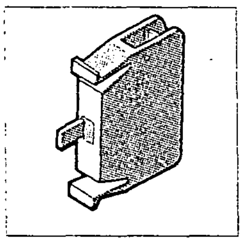
sprecher + schuh

Control & signalling units - DT 3 series

Technical information

Refer catalogue 1803



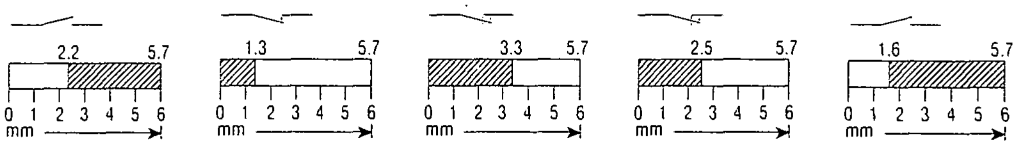


Contact blocks

Rated thermal current I_{th}							
open	(ambient 40°C)	10 A					
enclosed	(ambient 60°C)	6 A					
Nominal operating voltage U_e		AC 660 V					
Nominal operating current I_e							
AC 1		10A					
AC 15		220V	240V	380V	415V	500V	600V
		3A	3A	2.5A	2.2A	1.5A	0.75A
DC 15		24V	48V	110V	220V	440V	
DE 3 10/DE 3 01							
DA 3 10/DA 3 01		2A	0.6A	0.2A	0.1A	0.04A	
DE 3 L01/ DA 3 L01		1.3A	0.4A	0.13A	0.065A	0.026A	
Short circuit withstand							
without welding		10A slow					
Back up fusing permissible rated current							
fast	(D, gF)	16A					
slow	(DT, gL)	10A					
Switching frequency		6000 ops/h					
Electrical life	I_e	**0.1A**	**1A**	**2A**	**3A**		
(AC 15)	mill. ops.	10	3	1	0.5		
Contact security		reliable for switching electronic circuits					

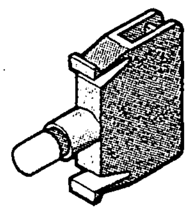
Clearance between open contacts ▨ On ☐ Off

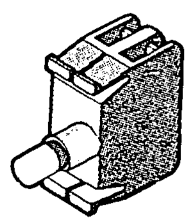
DE 3 10 DA 3 10	DE 3 01 DA 3 01	DE 3 L01	DA 3 L01	DA 3 E10

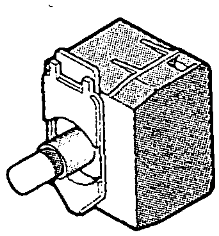


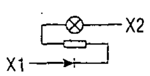
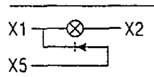
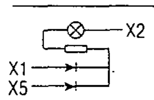
Terminal markings	to DIN EN 50 013
Connections	0.75 ... 2.5mm² 18 ÷ 12 AWG

Lamp elements





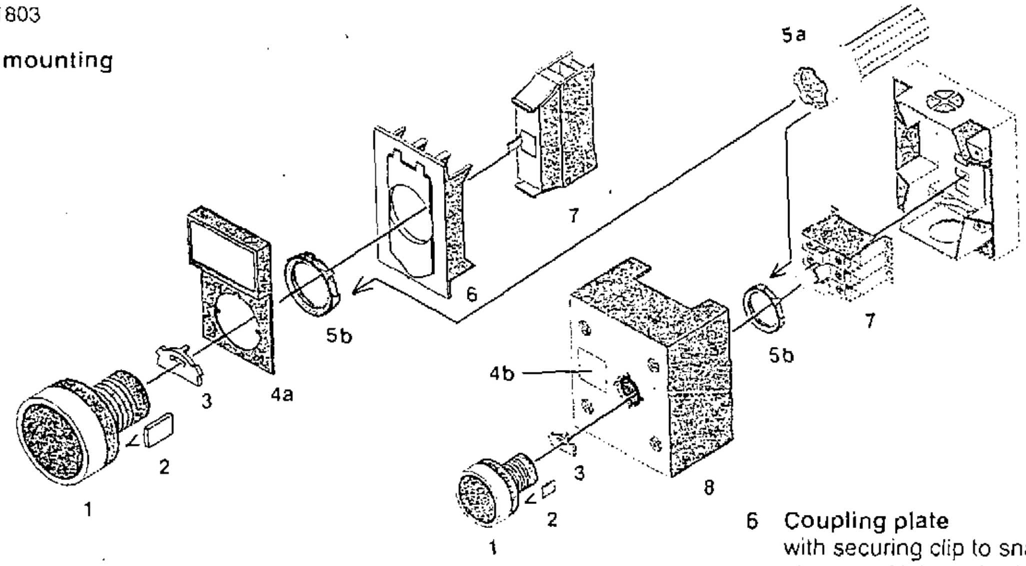


	Lamp elements DEL 3-E indicator lamps illum. pushbuttons and illum. switches	maximum permissible 2.6W 2W
X1—⊗—X2	**Standard element** with Ba 9s lamp holder for filament or neon lamps	Max. 130V filament lamp, or max. 250V neon lamp (28mm long, 10mm ∅)
	**Special elements DELD 3-C** with Ba 9s lamp holder with series diode and resistor for operating voltage for filament lamps	 AC 240V 130V (Refer pages 10 - 21)
	**DELK 3-K** with central lamp test for filament or neon lamps	Max. 130V filament lamp, or max. 250V neon lamp (28mm long, 10mm ∅)
	**DELDK 3-DC** with series diode and resistor with central lamp test for operating voltage for filament lamps	AC 240V 130V (Refer pages 10 - 21)
	**DU 3-** with transformer for filament lamps secondary: primary:	6V, max. 1.2W volt. 6V load max. 1.2VA, 50/60 Hz volt. 110...120V, 220...240V, 380...415V

Control & signalling units - DT 3 series
Mounting instructions

Refer catalogue 1803

Single person mounting
Front 1 ... 4
Rear 5 ... 7



1 **Front element**
round or square, push, with the markings at the top, into the 22.5mm hole in the mounting plate.

2 **Locking tabs**
for securing the front section against unauthorised removal. From the rear, insert 2 of these 90° apart into the front element.

3 **Bridge**
for operating contacts at position 3 (centre position). Fit to front element from the rear. Recommended with contact blocks on second level (2 bridges required).

4a **Legend carrier**
for additional inscription on front elements. Insert the tabs into the slots in the front element. (Refer page 10 - 23).

4b **Legend plates**
for additional marking of controls on enclosures (adhesive).

5a **Lock nut fixing tool**
for fastening lock nut (5b) onto panel.

5b **Lock nut (threaded) for front element**
is used to secure the front element to the panel/enclosure. Use locknut fixing tool to secure.

6 **Coupling plate**
with securing clip to snap onto front element. Not required for base mounting.

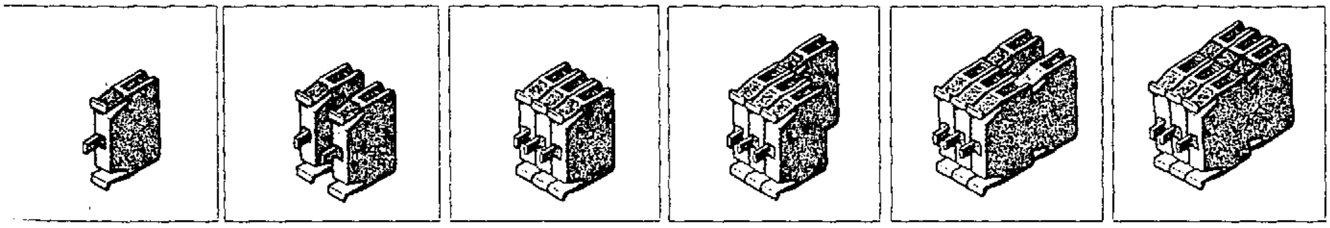
7 **Contact blocks and lamp holders flush mounting**
snap onto coupling plate, or the rear of an existing contact block (2 levels of contacts).

Base mounting
snap onto the inside of the enclosure base or onto a hat rail, or secure with two screwed fixing straps.

8 **Enclosures**
available in plastic and aluminium die cast and supplied in 4 sizes with up to 5 control points.

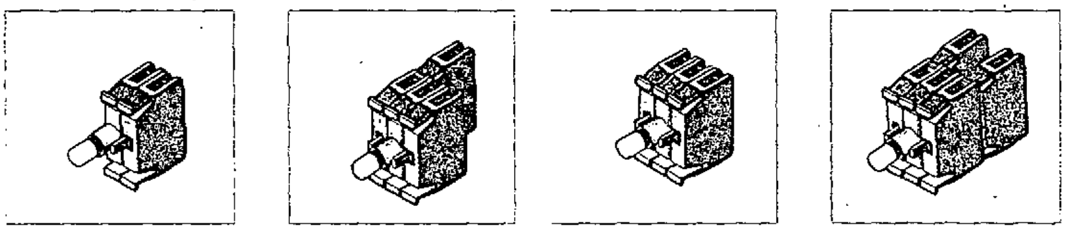
Permissible combinations of contact blocks and lamp elements

Pushbuttons DT 3, DTH 3, DTV 3, DTVH 3, DP 3, DPV 3, DPG 3, DPGV 3 rotary switches DSH 3, DSK 3, DSS 3



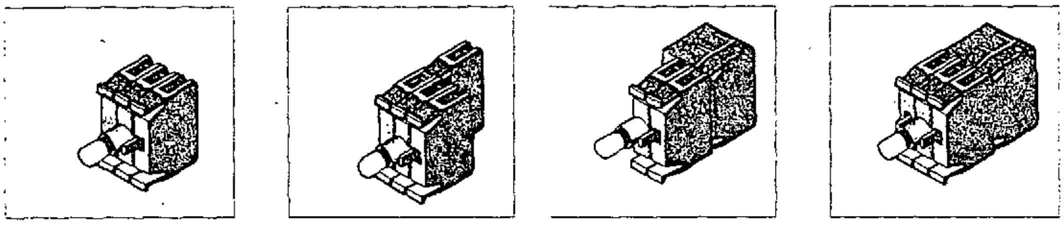
Illuminated pushbuttons DTL 3, DTLV 3 illuminated rotary switches DSHL 3, DSKL 3

For filament lamps 6 ... 110V for filament lamps with series diode 130V, 2.6W



For filament lamps with central lamp test 6...110V
for filament lamps with series diode and resistor and central lamp test 130V, 2.6W

With transformer element



10

T

SECTION T

INDICATING LIGHTS

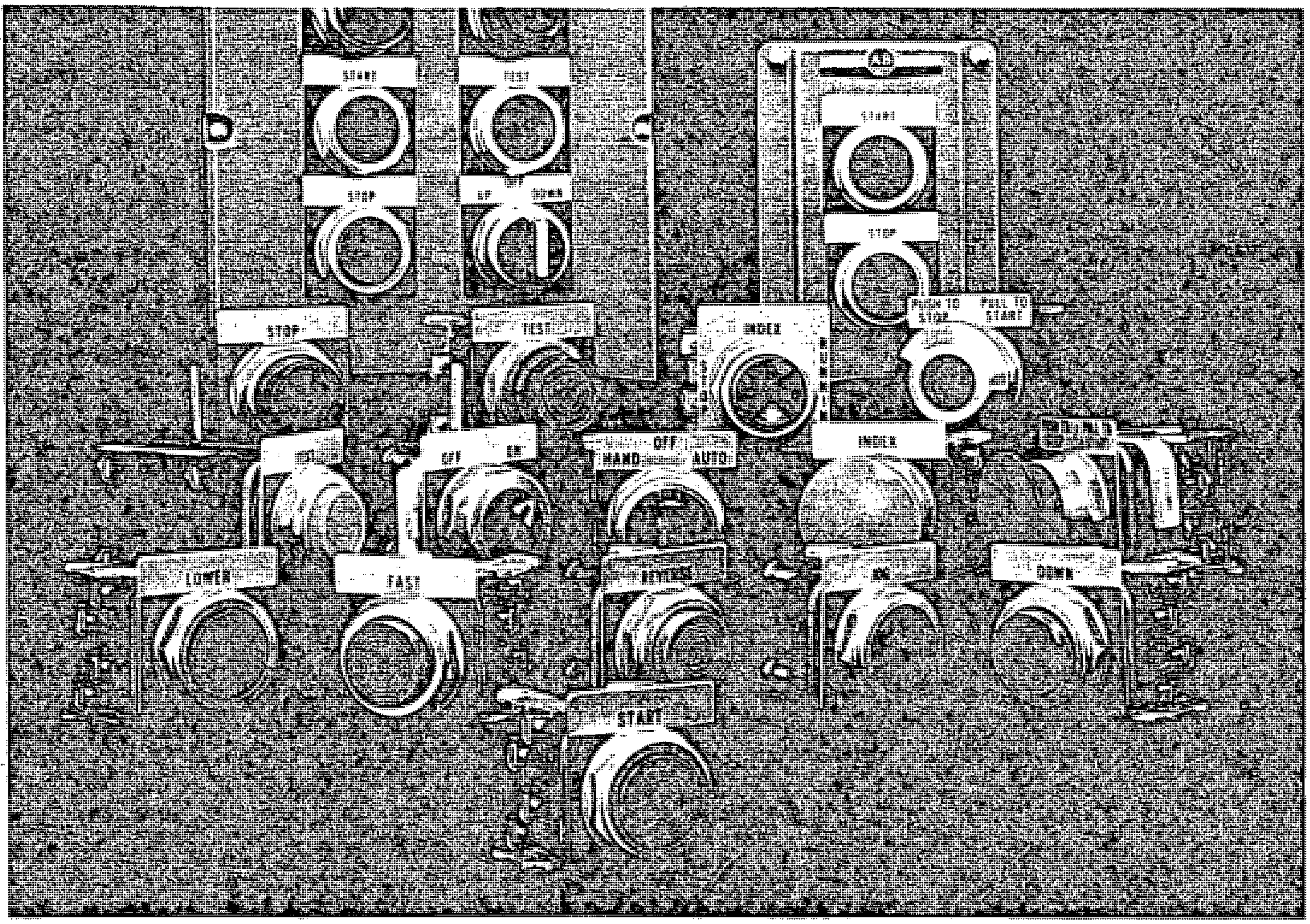
ALAN BRADLEY 800T SERIES

800T/PL SERIES 110/6V INDICATING LIGHTS
800T/PL SERIES 24V INDICATING LIGHTS

SUPPLIED BY: ASEA BROWN BOVERI DISTRIBUTION
6 EDMONDSTON ROAD
MAYNE QLD
TELEPHONE (07) 858 2417
FAX (07) 369 5125

A-B QUALITY

Bulletin 800T Oiltight push buttons

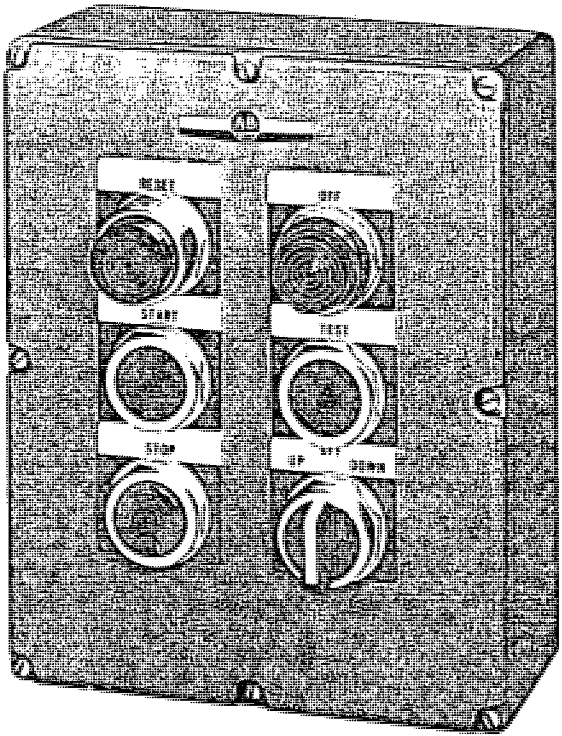


- Bulletin 800T oiltight devices provide a tight seal against most coolants, oils, and other non-corrosive industrial fluids.
- Ideal for demanding applications where controls must operate efficiently and dependably.
- Designed Oiltight and dust-tight to meet NEMA Type 13 standards.
- Offers a wide variety of oiltight control units to meet most industrial requirements.
- Listed by Underwriters' Laboratories, Inc.

Octagonal mounting ring system

Key features of the octagonal mounting ring system:

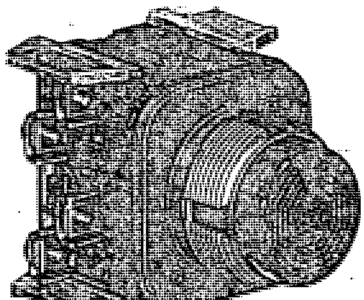
- Allows higher tightening torque for improved oiltight integrity.
- Easier legend plate alignment to enhance control station appearance.



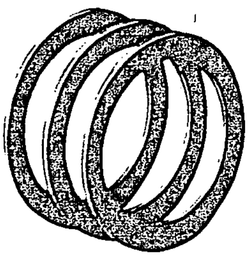
Attractive Control Station Appearance

Illustrated is a typical 6 Unit Custom Built control station. A variety of push buttons, selector switches, pilot lights, and accessories are available to meet the most specialized requirements.

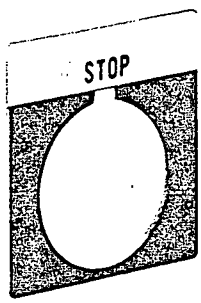
Up tight and oiltight



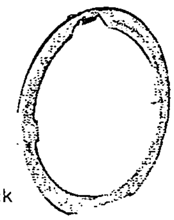
Operator and Contact Block



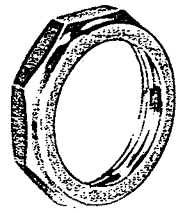
Sealing Gaskets



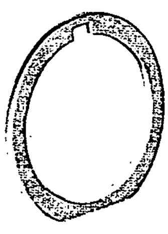
Legend Plate available in gray or red, with black lettering on anodized aluminum band.



Thrust Washer absorbs tightening torque, allowing legend plate to remain in alignment.



Octagonal Mounting Ring simplifies application of a higher tightening torque, which provides increased protection against loosening due to vibration.



Trim Washer provided for use when a legend plate is not required.

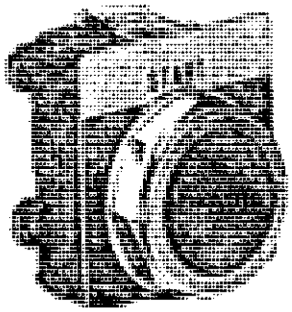
Push buttons

A complete line of Allen-Bradley, factory assembled, NEMA Type 13 oiltight push button operators and contact blocks.

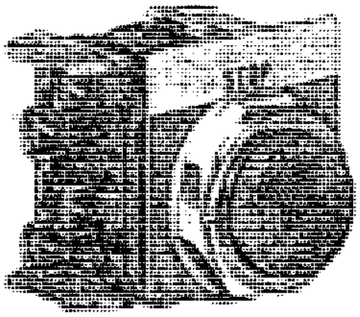
Available in 8 solid molded-in colors ... select from red, yellow, black, blue, orange, green, brown and gray so you can choose colors to identify individual functions.

Wide selection of accessory items ... available to meet most needs. Choose from guards, lockouts and more, all available in kit form for field installation. See pages 10 and 11 for illustrated listings.

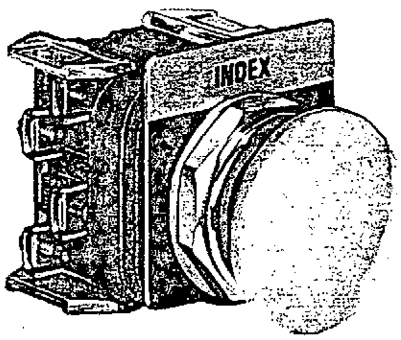
Full choice of operators ... illustrated are some of the popular Bulletin 800T operators to satisfy most applications.



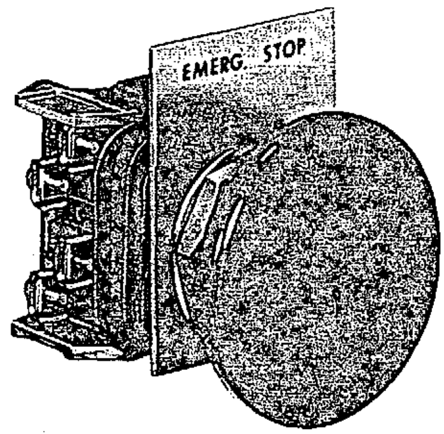
Flush Head is suitable for most initiating applications.



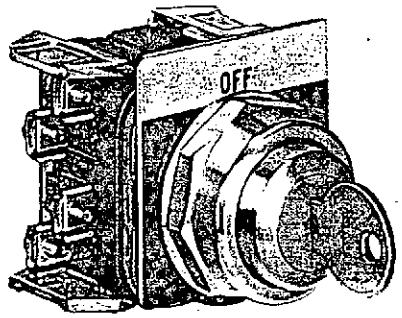
Extended Head for easy operation in "STOP" application.



Mushroom Head where greater accessibility is required.



Jumbo Mushroom Head has 2-1/4" diameter for even greater accessibility.



Cylinder Lock available with many different locking functions.

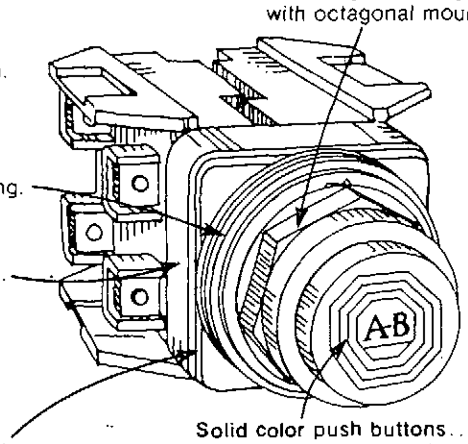
Attractive design ... low silhouette keeps projection in front of panel to a minimum.

Fast easy mounting ... with octagonal mounting ring.

Oiltight Integrity ... gaskets guard against contaminants entering through panel opening.

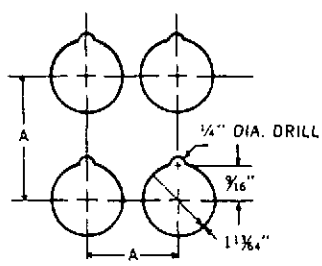
Rugged die cast body ... provides for rigid mounting.

Factory assembled ... each push button is shipped ready to install.



Tough diaphragm seal ... guards against contaminants entering around the button.

Solid color push buttons ... color is molded throughout the button. No inserts to be lost or removed. Color identification never lost.



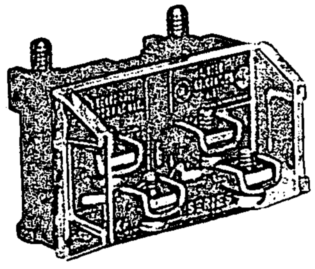
Mounting Information (Dimension A)
Where contact block terminals face each other, 2-1/4" spacing is required for proper electrical clearance. Where terminals do not face each other, 1-27/32" spacing can be used. Transformer Type Pilot Lights, Push-to-Test Pilot Lights, Illuminated Push Buttons, and all Push-Pull Push Buttons, require 2-1/4" spacing.

Contact blocks

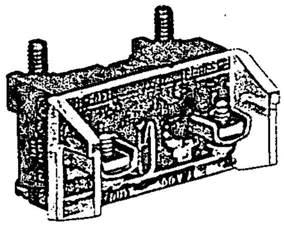
Versatile, modular

Here's the planning and installation flexibility that modular contact blocks offer. A family of modular contact blocks is used throughout the Bulletin 800T line. Double break, fine silver contacts are enclosed to offer additional protection against contaminants and yet allow visual contact inspection.

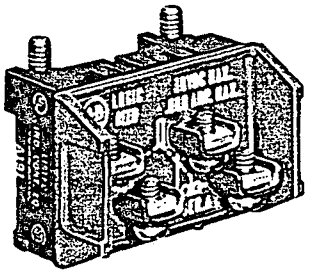
A wide variety of contact arrangements in basic shallow, mini, logic reed, and sealed switch contact blocks... flexible and modular. Special time delayed and snap action contact blocks also available. Separate blocks are available with mounting hardware for field installation.



Basic Shallow. Five basic contact arrangements available.



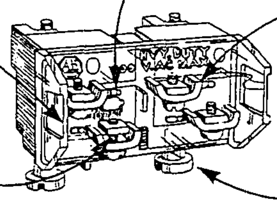
Mini. Ideal for additional contacts where depth is limited. Block 7/8" deep.



Logic Reed. Five basic arrangements available. High reliability for low power circuits.

CONTACT RATINGS

	AC						DC	
	Maximum Contact Rating Per Pole NEMA Rating Designation A600						Maximum Rating NEMA P600	
	Max. AC Voltage 60 or 50 Hz.	Amperes		Continuous Carrying Current	Voltamperes		Voltage Range	Ampere Rating
		Make	Break		Make	Break		
Shallow & Mini	120	60	6	10	7200	720	115-125	1.1
	240	30	3	10	7200	720	230-250	0.55
	480	15	1.5	10	7200	720	550-600	0.20
	600	12	1.2	10	7200	720		
Logic Reed	Maximum: 150 VAC, .15 AMPS, 8 VA and 30 VDC, .06 AMPS, 1.8 VA, should only be used with resistive loads.							



Reliable contact operation with fine silver, double break contacts. Basic shallow and mini blocks only.

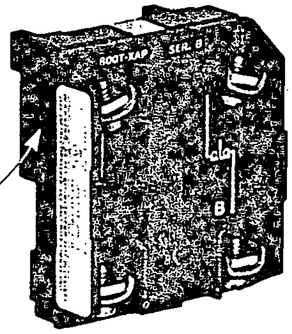
Convenient wiring. Ample wiring room and staggered terminals for easy access.

Clear side plate for fast visual contact inspection. Contacts can be checked at a glance. Basic shallow and mini blocks only.

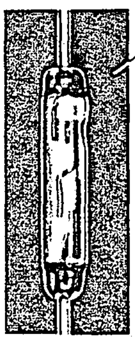
Easy wiring, self-lifting pressure clamps cut wiring time to a minimum.

Special captive mounting screws. Second contact block can be added under same screw. Tandem blocks can be added by utilizing tapped head. Applies to shallow block only.

Class I, Division 2, Hazardous Locations and other Harmful Environments



Sealed Switch Contact Block



Hermetically Sealed Switch Contact

CONTACT RATINGS

	AC						DC	
	Maximum Contact Rating Per Pole NEMA Rating Designation B600						Maximum Rating NEMA P300	
	Max. AC Voltage 60 or 50 Hz.	Amperes		Continuous Carrying Current	Voltamperes		Voltage Range	Ampere Rating
		Make	Break		Make	Break		
Sealed Switch	120	30	3	5	3600	360		
	240	15	1.5	5	3600	360	115-125	1.1
	480	7.5	.75	5	3600	360	230-250	0.55
	600	6.0	0.6	5	3600	360		

Sealed Switch block available in a variety of contact arrangements to meet most requirements. The sealed switch contact is hermetically sealed in glass for protection against contaminants.

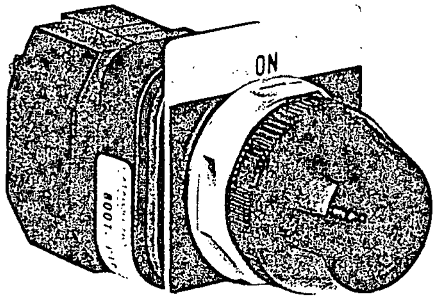
For greater versatility the sealed switch contact block can be mixed or matched with existing Series C shallow, mini, or the logic reed block. **NOTE** — Sealed switch contact blocks **should not be used** with any mushroom head or push-pull push buttons, as heavy shock operation may result in contact block damage.

The sealed switch contact block is suitable for use in Class I Division 2 Groups A, B, C and D hazardous locations and is listed by Underwriters Laboratories for this class of service. It is possible with the sealed switch contact block to use a lower classification enclosure than the NEMA Type 7 Hazardous Location Enclosure in Class I, Division 2 Locations. Refer to Page 9 for additional information.

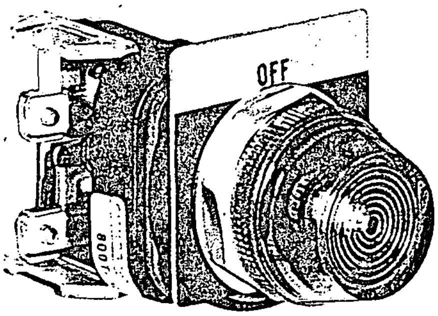
Pilot lights and Illuminated devices

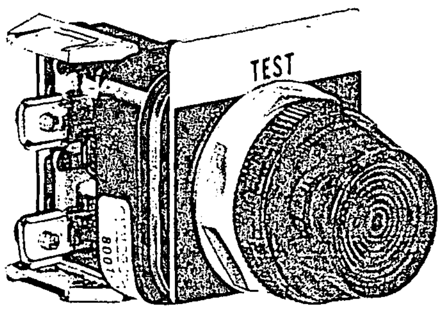
Allen-Bradley offers a wide variety to fit virtually any application. Mounting is identical to the Bulletin 800T push buttons and selector switches.

Wide Variety of Colors... color caps are available in red, green, amber, blue, white, or clear for all devices except the neon type pilot light which is only available in amber and clear color caps.



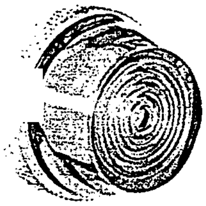
Transformer Type where controls are subject to normal machine shock and vibration. Transformer allows use of low voltage lamp for long life. Optional glass color caps are available.

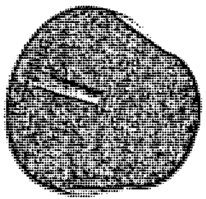


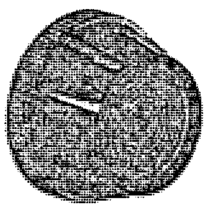


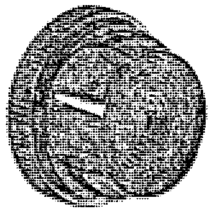
Full Voltage Type. Across the line up to 240 volts. Use where pilot light will not be subjected to appreciable shock or vibration.

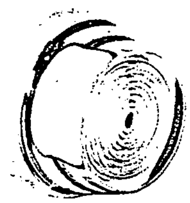
Neon Type. Across the line up to 240 volts.

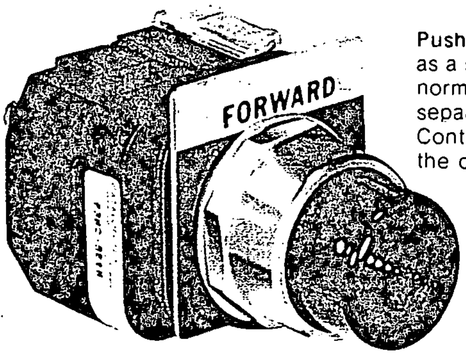






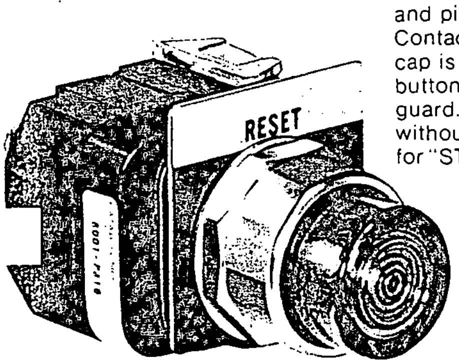


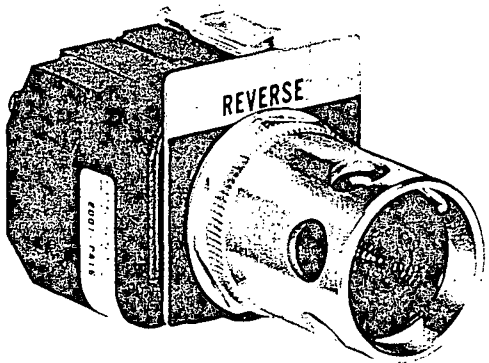




Push-to-Test Type function as a standard pilot light in normal state and provides a separate circuit for lamp test. Contacts will operate when the cap is depressed.

Illuminated Push Button does double duty as both push button and pilot light in a single unit. Contacts designed to operate when cap is depressed. Illuminated push buttons are available with or without guard. Generally, the push button without a guard is recommended for "STOP" applications.



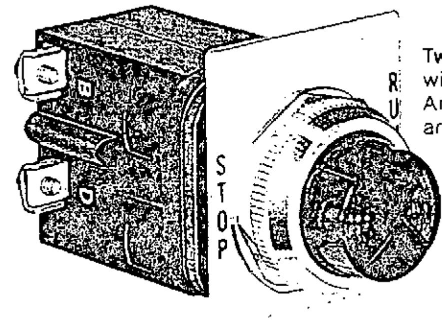


Illuminated Push Button with Guard

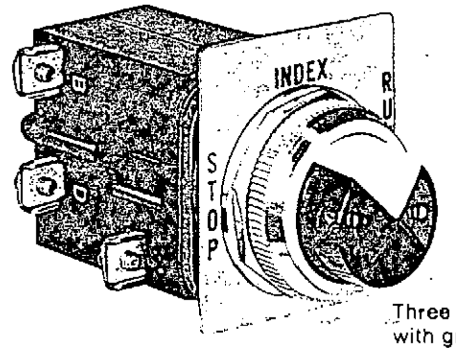
6

Cluster pilot lights

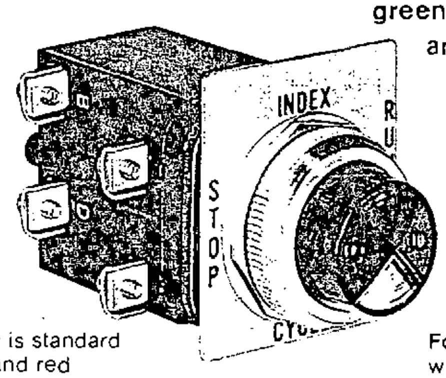
Provides several indicating lights in the space of a single unit. Available as 2, 3 or 4 pilot light cluster. Each has its own transformer rated at 120 volts, 50/60 Hz. Any combination of green, blue, red, clear, white and amber are available.



Two Light Cluster is standard with green and red color caps. Any combination of six colors are available.

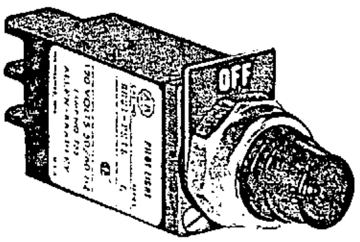


Three Light Cluster is standard with green, white, and red color caps. Any combination of six colors are available.



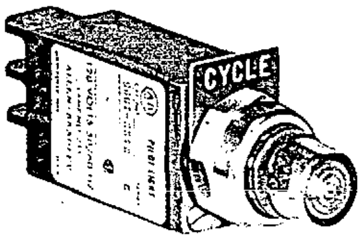
Four Light Cluster is standard with green, blue, red and clear color caps. Any combination of six colors are available.

Small pilot lights

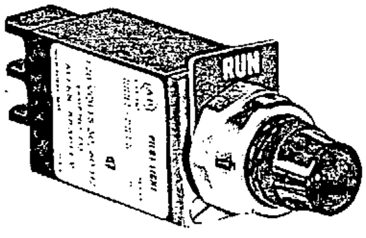


Small Pilot Light is ideal where space is of the essence.

Available in transformer construction at 120 volts; full voltage from 6 to 24 volts; or 120 volt neon bulb type.

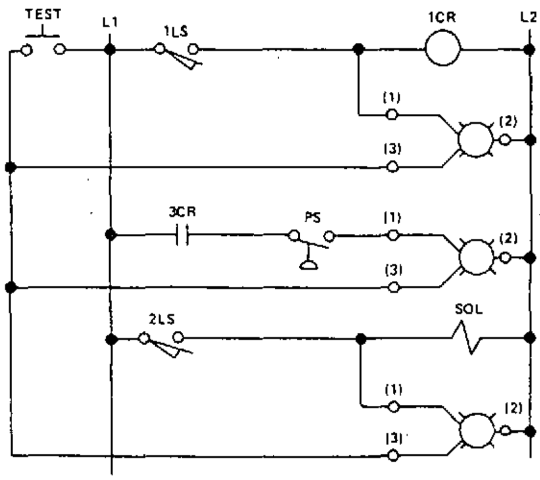


Small Push-to-Test with the same features as standard pilot light plus contacts for push-to-test function.



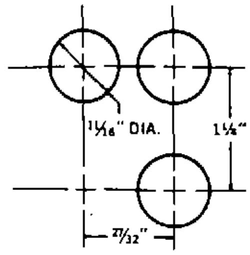
Small Dual Input has a unique construction which permits testing a number of pilot lights from a single push button. Applications include flow diagrams of a control panel, pilot lights on a test panel, and any other process where a multiple number of push-to-test type pilot lights are needed. See Application diagram for typical circuit.

The internal design of the Bulletin 800T dual input device contains a diode circuit which isolates the test supply from the normal supply. Since the input circuits are internally isolated, this pilot light may be energized from either or both of two separate inputs having the same polarity. The internal diodes are protected against damage by transients normally present in relay and solenoid circuits.



Mounting Dimensions

Mount in 11/16" diameter holes on 27/32" x 1-1/8" centers to allow a greater density of lights in a given space.



7

Push-pull devices

Illuminated and Non-Illuminated. Combine t-stop and pilot light functions in one button. Low silhouette construction, modular contact blocks, and modular constructed transformer in illuminated and non-illuminated push-pull. Ideal where space is at a premium.

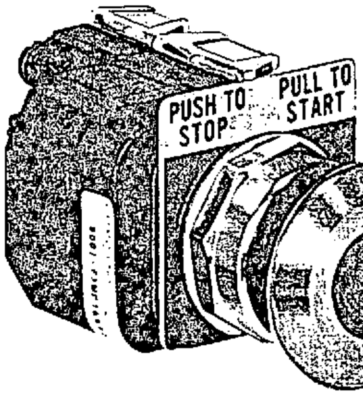
Two position with maintained contacts. When operator is pushed in, it will maintain position until manually pulled out.

Three position with center as normal position. In and out are momentary. Ideal for three wire motor starting control circuits with "push to stop" and "pull to start" legends.

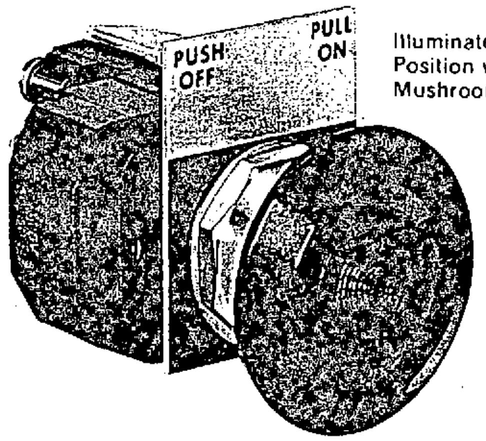
Three position with button maintained in the depressed position which keeps stop circuit open until manually returning button to the center position.

Types available include: transformer type, full-voltage type, neon bulb type. Both illuminated and non-illuminated can be furnished with a variety of contact blocks.

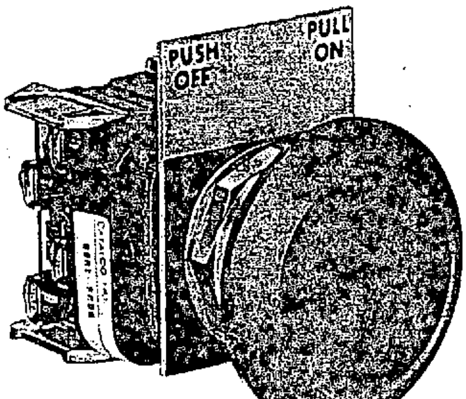
Color caps. Illuminated available in amber, blue, clear, green, red and white. Non-illuminated available in red, green, blue, yellow, orange, gray or black.



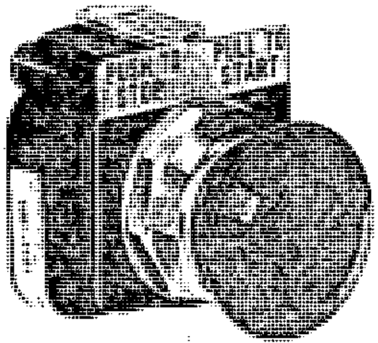
Illuminated 3 Position



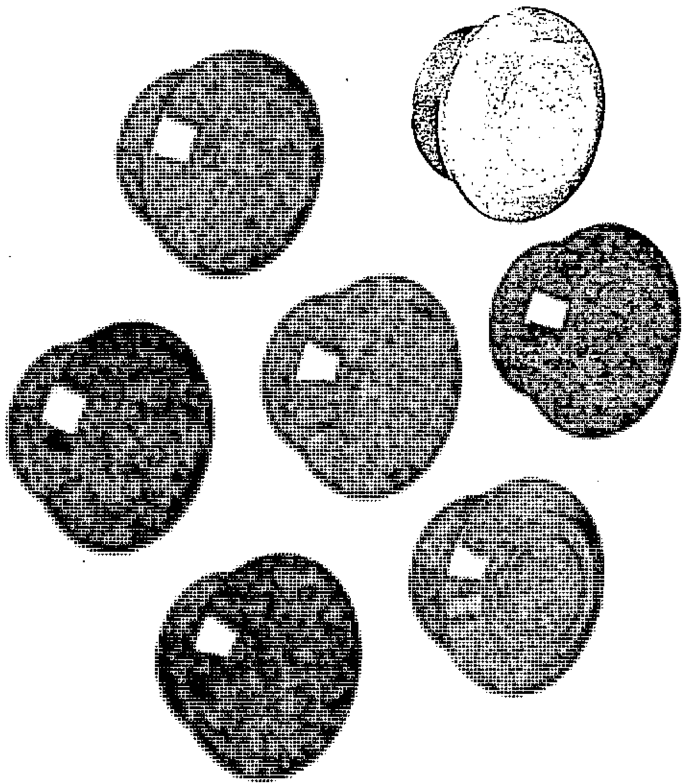
Illuminated 3 Position with Jumbo Mushroom Head



Non-Illuminated 2 Position with Jumbo Mushroom Head

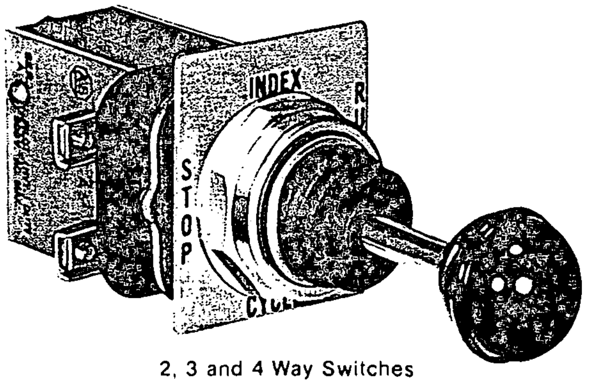


Non-Illuminated 2 Position

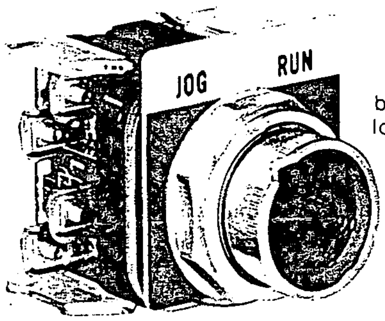


Special purpose devices

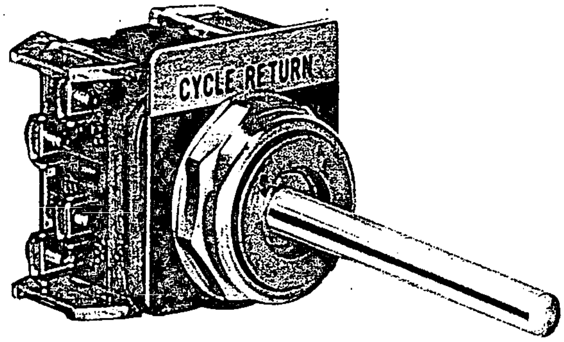
Available in a wide variety to complement the Bulletin 800T line. In addition to those illustrated, a number of other devices and contact arrangements are available.



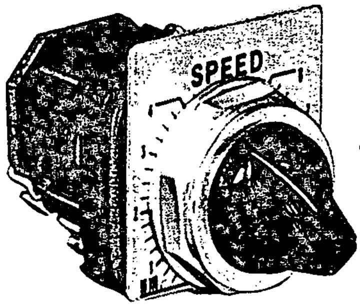
2, 3 and 4 Way Switches featuring handy joy stick operator for convenience in multi-purpose control operations.



Selector Jog. A 2 position device combining a momentary contact push button with a selector switch. Ideal for run-jog applications.



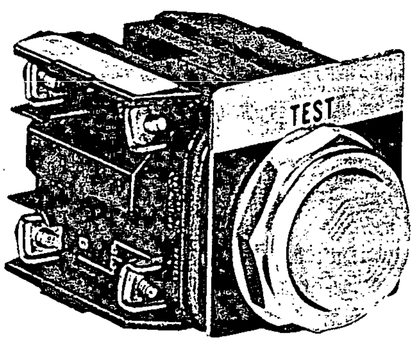
Wobble Stick with operator that can be moved in any direction to actuate the contact blocks. Spring action lever return to the center position.



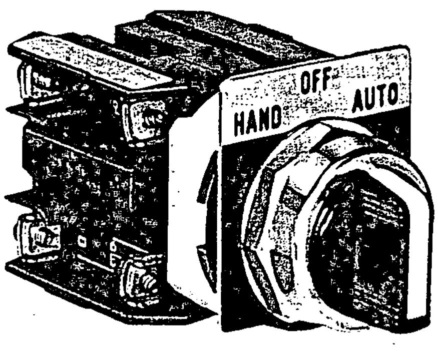
Potentiometers consist of Allen-Bradley Type J potentiometer and suitable oiltight mounting. Available up to 10 megohms.

*Class I Division 2 for Hazardous Locations

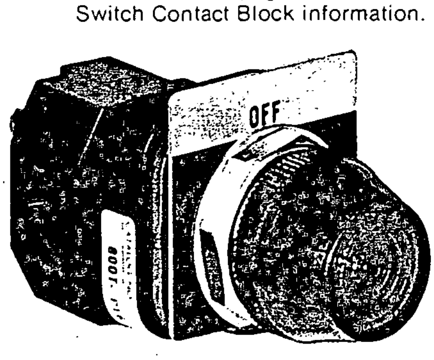
Typical devices shown below are suitable for Class I, Division 2 locations provided they are suitably mounted by the customer in an enclosure as required for the application and by applicable codes and laws. Refer to page 5 for Sealed Switch Contact Block information.



Push Button utilizing the hermetically sealed switch contact (Also available in Bulletin 800H NEMA Type 4X Rosite units).



Selector Switch utilizing the hermetically sealed switch contact (Also available in Bulletin 800H NEMA Type 4X Rosite units).

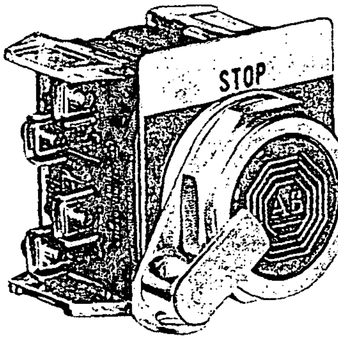


Pilot Lights, Transformer, Neon, and Full Voltage Types are available.

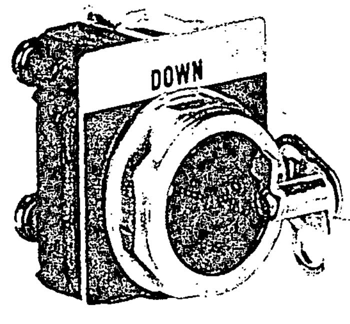
*For complete push button stations, contact your local A-B representative for information on Bulletin 800R.

Accessories

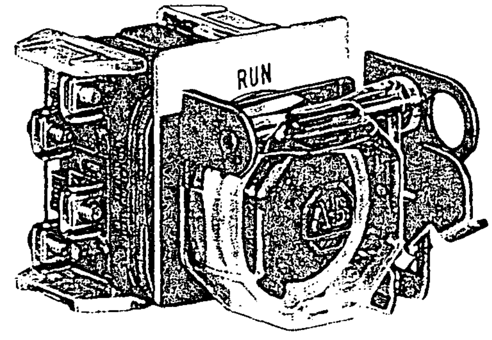
Popular modifications and accessories readily available for the Allen-Bradley Bulletin 800T line.



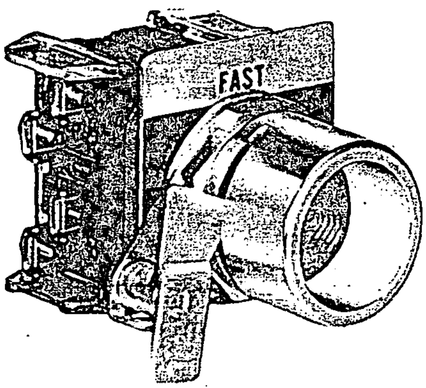
Locking attachment for extended head push buttons. This field installable kit enables the button to be locked in the depressed position.



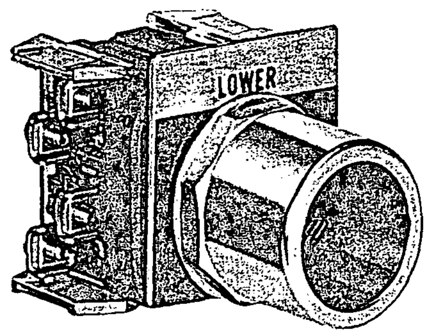
Padlocking attachment for flush head push button units to permit locking in depressed position.



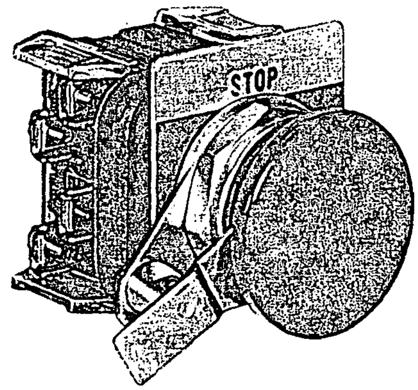
Locking Cover featuring a stainless steel mounting bracket with a clear plastic cover. Guards against unauthorized operation. Available for push buttons and selector switches.



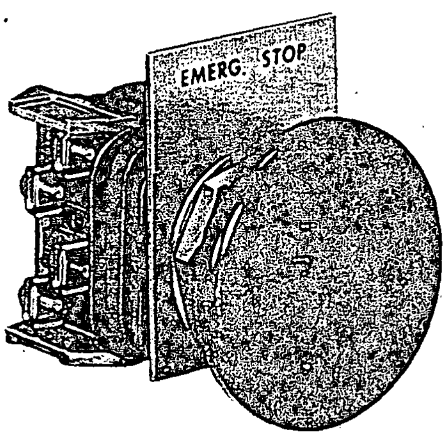
Extra Long Guard with Padlocking Attachment which permits extended head to be locked in the depressed position.



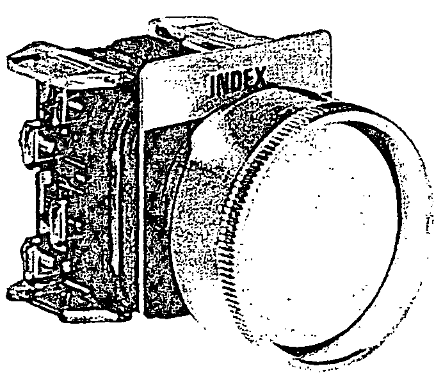
Push Button Guard is 1" deep for additional protection against accidental operation.



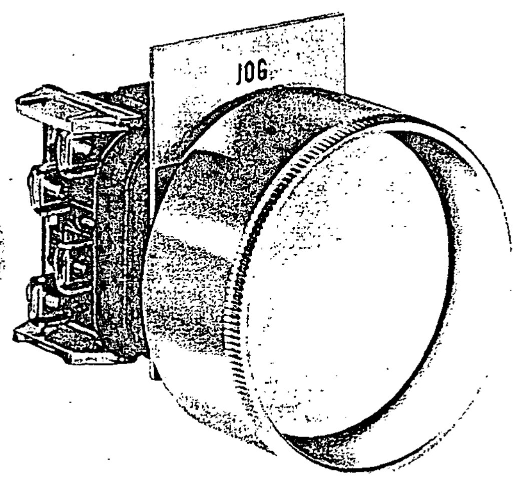
Mushroom Head Padlocking Kit consists of mushroom head operator with locking attachment.



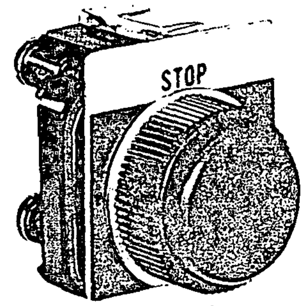
Jumbo Mushroom Head is available in plastic or aluminum



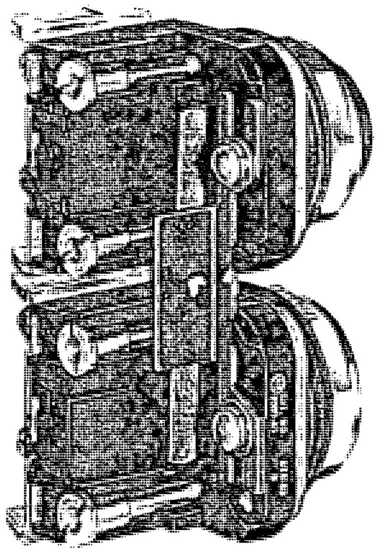
Mushroom Head Guard available for standard mushroom head operators. Useful when mushroom head is used to initiate a function.



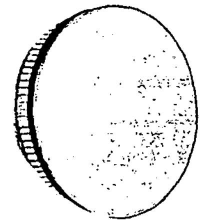
Jumbo Mushroom Head Guard



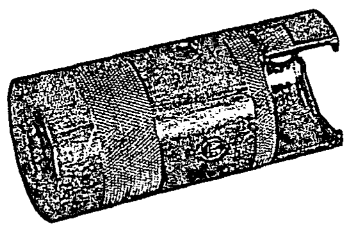
Rubber Boot suitable for flush or extended push buttons, provides additional protection from contaminants. Available in black, red or green.



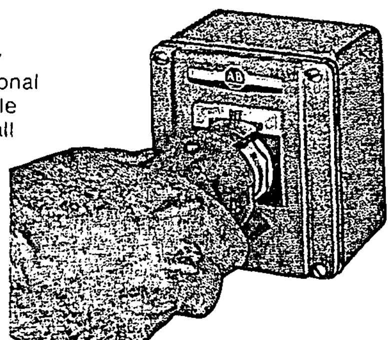
Mechanical Interlock Assembly guards against operation of 2 interlocked buttons at the same time.

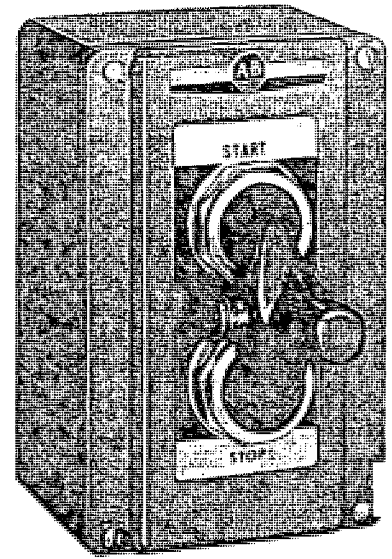


Closing Button is used to fill unused holes in enclosure or panel to form an oiltight seal. Kit consists of durable molded plug, synthetic rubber washer and mounting ring.



Mounting Ring Wrench will simplify tightening and loosening the octagonal mounting ring. This wrench is double ended and can be used for the small size pilot light mounting rings in addition to the standard size.





Rocker Arm Operating Lever is useful where attendant must wear heavy gloves and still operate 2 push buttons repeatedly. When lever is released it returns to center position. Kits available for field installation.

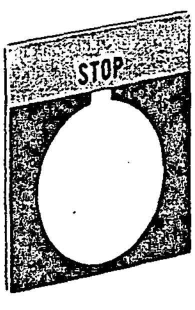
Legend plates

Legend plates are available in standard, jumbo and large sizes. These legend plates are gray or red in color and feature a natural aluminum engraving area across the top.

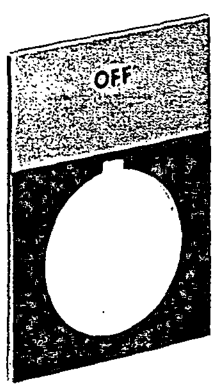
Standard size legend plates will accommodate 2 lines with 14 characters per line. Jumbo legend plates will accommodate 14 characters in one line with provisions for a total of 5 lines. Large size legend plates (2.4 inches square) provide 4 lines with 20 characters per line. Large and Jumbo legend plates require greater center to center spacing.

These legend plates can be field engraved with a .020 inch carbide cutter. Black letters are then obtained by treating the freshly engraved plate with a blackening fluid which is used to darken the letters engraved in the new legend plate.

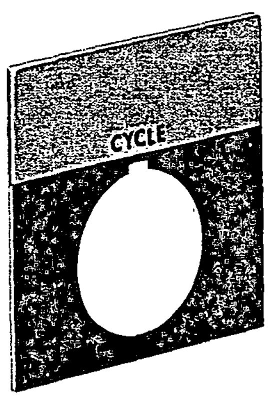
Standard size legend plates with standard markings are factory stocked. Special engraving and custom markings are also available.



Standard



Jumbo



Large

11

U

SECTION U

CONTROL & STATUS MONITORING UNIT

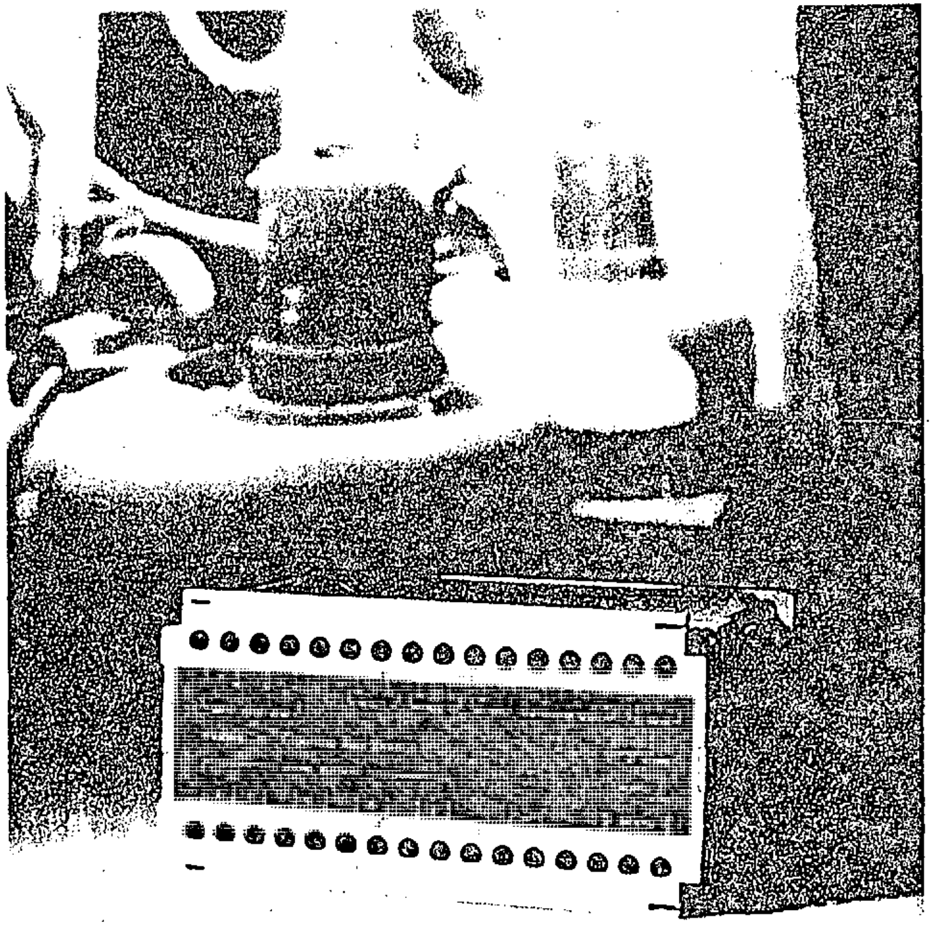
ITT FLYGT CAS SERIES

SUPPLIED BY: ITT FLYGT LIMITED
14A DEVLON STREET
MANSFIELD QLD 4122
TELEPHONE (07) 849 7477
FAX (07) 849 7633

83 58 40 CAS 01.04. Eng. 2M. 11.88 © FLYGT AB   *Printed in Sweden*   Wikströms 882396

MONITORING UNIT
83 58 40 CAS

INSTALLATION and SERVICE



Flygt undertakes to remedy faults in products sold by Flygt provided:

— that the fault is due to defects in design, materials or workmanship;
— that the fault is reported to Flygt or Flygt's representative during the guarantee period;
— that the product is used only under conditions described in the care and maintenance instructions and in applications for which it is intended;
— that the monitoring equipment incorporated in the pump/turbine is correctly connected;
— that all service and repair work is done by a workshop authorized by Flygt.

Hence, the guarantee does not cover faults caused by deficient maintenance, improper installation, incorrectly executed repair work or normal wear and tear.

Flygt assumes no liability for either bodily injuries, material damages or economic losses beyond what is stated above.

The manufacturer reserves the right to alter performance, specifications or design without notice.

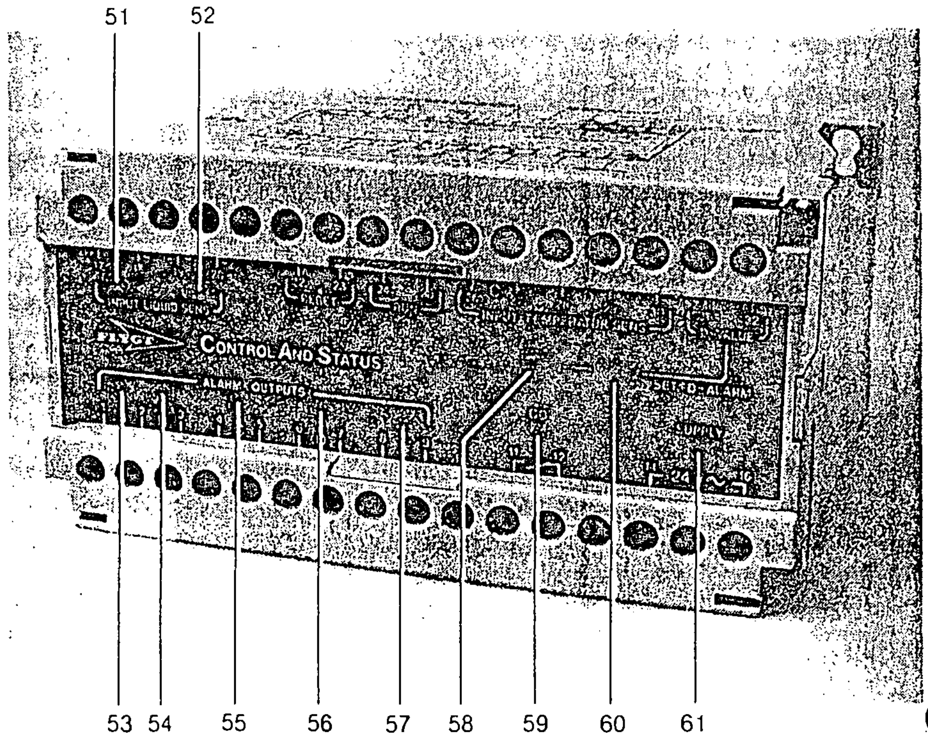
CONTENTS

Flygt's monitori   ıit, 83 58 40, is designed for use i   ımps from model 3230 and larger models equipped with drive units 680-940. Turbines equipped with generators 760-930 are also covered by the monitoring system.

The monitoring unit is connected to the standardized range of sensors incorporated in all the products covered.

These instructions **do not** apply to units delivered with article number 83 58 41, which are programmed for other functions. The fault tracing scheme applies to the standard version 83 58 40 only.

The figures in the text refer to the numbers on the front cover (1—32) and also to the picture below (51—61).



FUNCTIONS

Channel A, liquid level

This channel is used, for example, for monitoring of possible liquid leakage into the stator casing. A sensor is incorporated in the lower part of the stator casing. The sensor changes resistance from about 1.5 kΩ to about 300 Ω if liquid enters.

Input indication

The pilot lamp 51 is lit to indicate interruption or shortcircuit.

Alarm

After alarm for about 5 seconds, the alarm function A is activated, the red pilot lamp 53 is lit, the Σ alarm function is activated (the pilot lamp is lit) and the interlock (11—12) drops, whereby the pump/turbine is disconnected and the pilot lamp 59 will go out.

Reset

Resetting can only be done manually.

Channel B, oil pressure (or liquid level).

This channel with RUN connected to a normally open contact is to be used to monitor the oil pressure in machines equipped with a gear unit. On machines without a gear unit, the channel can be used in the same manner as channel A, provided that RUN is not connected.

Input indication

The pilot lamp 52 is lit to indicate interruption or shortcircuit. If the channel is not used (machines without a gear unit) the pilot lamp will always light.

Alarm

After alarm for about 5 seconds, the alarm function B is activated, the pilot lamp 54 is lit, the Σ alarm function is activated, the pilot lamp 57 is lit and the interlock (terminals 11 and 12) drops, whereby the pump/turbine is disconnected and the pilot lamp 59 will go out.

Channel C, temperature monitoring

This channel is intended to monitor the stator's temperature with thermal switches or up to 3 PTC thermistors. The thermal switches are normally closed but they open at 155°C ±5°C (311°F).

Alarm

When the resistance exceeds 3 k Ω, the alarm function C is activated, the pilot lamp 55 is lit, the Σ alarm function is activated, the pilot 57 is lit and the interlock (terminals 11 and 12) drops, whereby the pump/turbine is disconnected and the pilot lamp 59 is extinguished.

Reset

Resetting can   be done manually and only when t   sistance has fallen to about 900 Ω, i e the stator has cooled.

Channel D, Pt 100 sensor

This channel is used for monitoring and analog indication of the temperature of the lower bearing. The channel can only be connected to a temperature sensor of type Pt-100 (DIN 437 60). The alarm value can be set by potentiometer 60 (see fault tracing).

Indicator instrument (extra equipment)

The channel has an output for analog reading of the bearing temperature. An indicator instrument can be connected to terminals 31 and 32 (NOTE! Correct polarity ±). The instrument shows the Pt-100 sensor's temperature. If switch 58 is depressed, the instrument shows the set alarm value.

Alarm

When the alarm value is reached, the alarm function is activated, the pilot lamp 56 is lit and the Σ alarm function is activated. The pilot lamp 57 is lit and the interlock (terminals 11 and 12) drops, whereby the pump/turbine is disconnected and the pilot lamp 59 will go out.

Adjustment of alarm value

The unit is delivered set to an alarm value of 100°C (212°F). As most bearings are running at lower temperatures it is recommended to set the alarm value individually for each machine.

Let the machine run for one or two hours so that the bearing reaches running temperature. If the temperature is stable during a period of time put the alarm value at 15—20°C (25—35°F) above the measured temperature. The margin will normally cover the changes in water temperature and variation in load.

Reset

Resetting can only be done manually.

ELECTRICAL CONNECTIONS

The monitoring is designed to be installed in a control panel. The unit can be mounted either on a 35 mm symetric DIN rail, or directly on a mounting plate. The drawing on page 5 shows the positioning of the drill holes for mounting on a flat surface.

The electrical connections shall be made in accordance with the electrical diagram (see also the top of the unit).

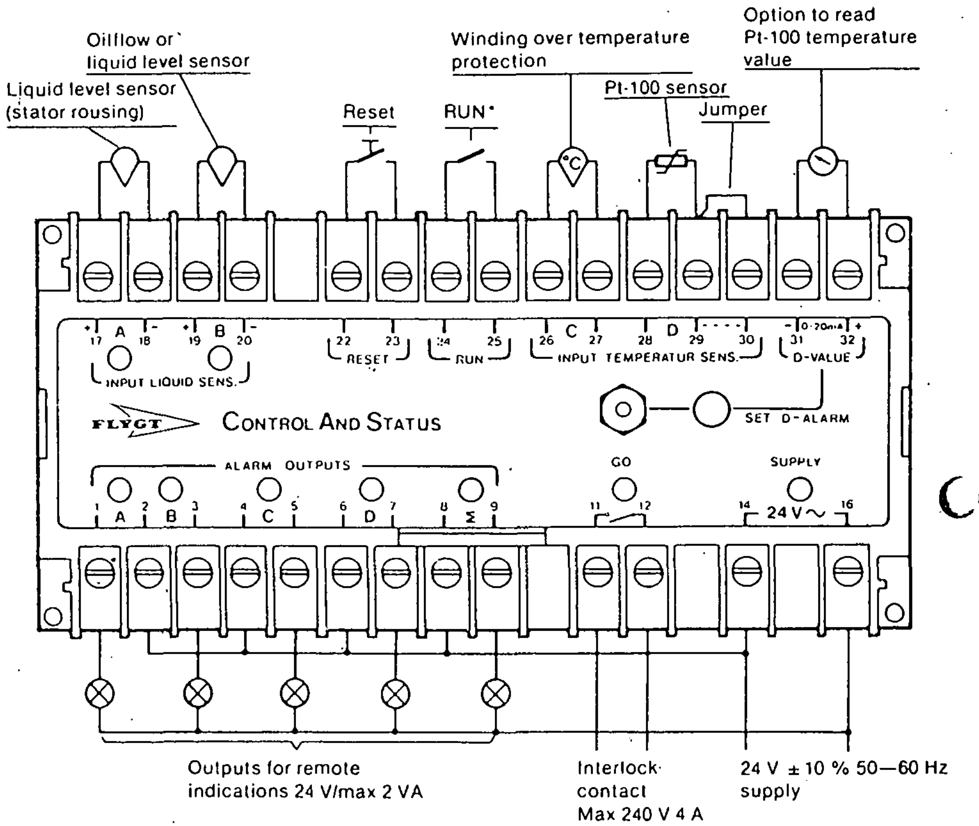
Connect a 24 VAC power source to terminals 14 and 16. Connect a normally open spring switch for reset after alarm between terminals 22 and 23.

Connect the starter's interlock circuit between terminals 11 and 12 so that the pump/turbine is shut off when an alarm is issued.

Connect 29 and 30 with a jumper, except when a 3-lead system for compensation for the resistance of the sensor leads is used.

Check before start that all leads are connected to the right terminals and that the screws are tightened.

Disconnect all connections with voltages higher than 24 V before working on the unit.



* To be connected only when oil pressure is monitored

TECHNICAL DATA

Supply voltage	24 V ±10 % 50—60 Hz
Power consumption	Ca 5 VA
Dimensions mm (in)	(W x H x D) 150 x 70 x 112 (5.9 x 2.8 x 4.4)
Temperature range	0°C — +50°C (32°F—122°F). Max 80 % RH

Channel A

Voltage to detector	12 V
Alarm	I > 20 mA
Output alarm	Solid state relay 24 VAC 100 mA

Channel B

Voltage to detector	12 V
Alarm	I > 20 mA (I < 20 mA if RUN is activated)
Output alarm	Solid state relay 24 VAC 100 mA

Channel C

Alarm	R ≥ 3 kΩ
Output alarm	Solid state relay 24 VAC 100 mA
Reset	Manual when R < 900 Ω

Channel D

Alarm	R > R_{set}
Output alarm	Solid state relay 24 VAC 100 mA
Output	0—20 mA range 50°C—150°C (122°F—302°F) (0.2 mA/°C ±2,5 %)

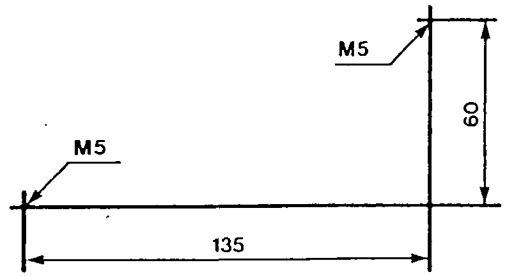
Σ-alarm

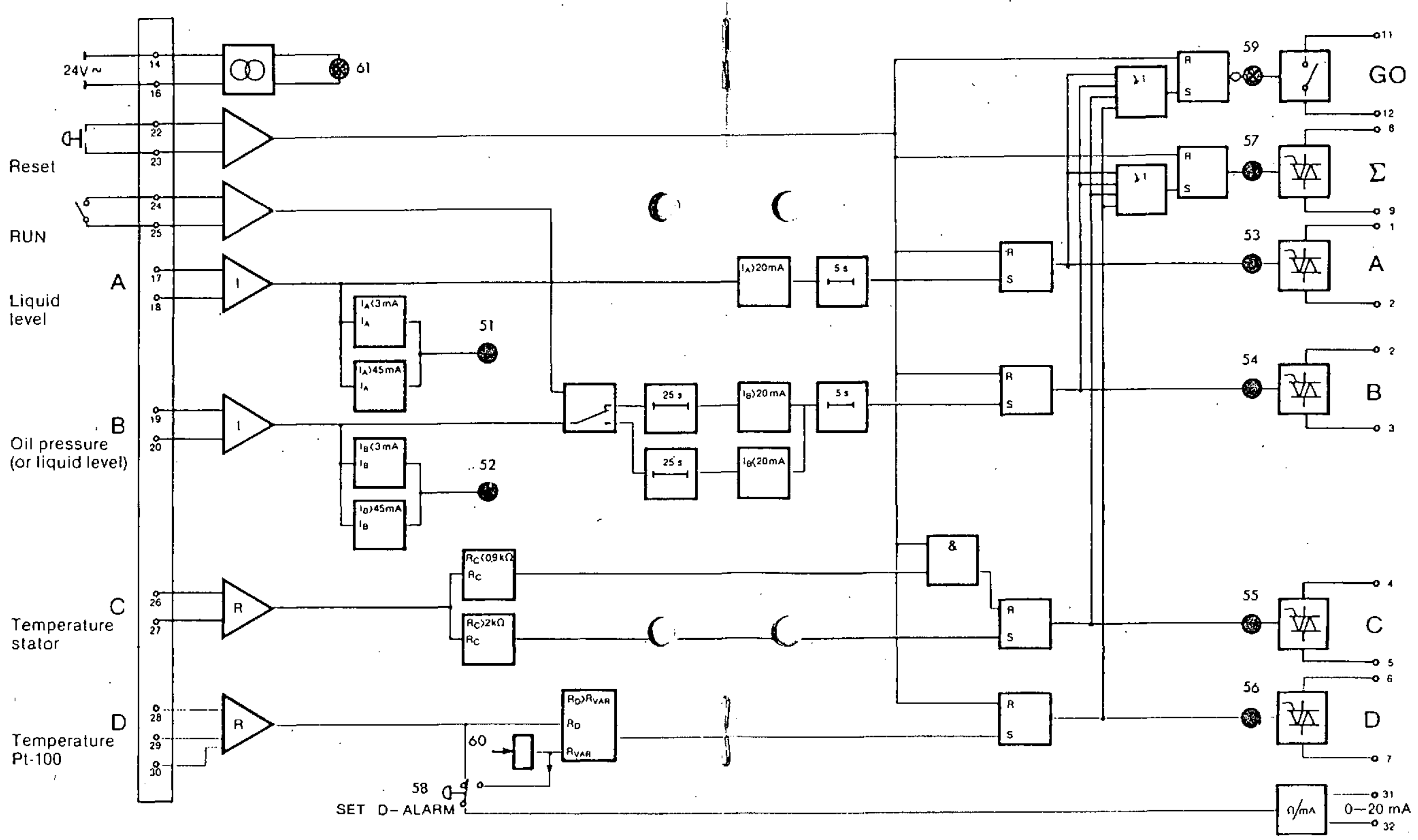
Alarm	Activated by alarm from each individual channel
Output alarm	Solid state relay 24 VAC 100 mA.

Interlock

Alarm	Activated by alarm and supply failures
Function	Normally closed
Breaking capacity	240 V 4 A at cos φ = 1

Drilling instruction




24V ~
14
16
61
22
23
Reset
24
25
RUN
A
17
18
Liquid
level
B
19
20
Oil pressure
(or liquid level)
C
26
27
Temperature
stator
D
28
29
30
Temperature
Pt-100
51
52
60
58
SET D-ALARM
I
R
25 s
5 s
&
59
57
53
54
55
56
GO
Σ
A
B
C
D
0–20 mA
11
12
8
9
1
2
3
4
5
6
7
31
32

6

FAULT TRA IG (TROUBLE SHOOTING)

With the aid of a multimeter and a couple of resistors, it is possible to check from the outside whether the unit is functioning properly. The multimeter shall have an internal resistance of at least 20 k Ω/volt.

In order for the monitoring unit to function properly, the supply voltage must lie within the specified limits, i e 24 V ± 10 %.

It is important to check the accurancy of the resistors resistance before using them to check the D-channel.

All functions shall be tested during fault tracing. If any function is not right, contact your Flygt service shop.

Supply voltage

Is pilot lamp 61 lit?
- No → Check that the supply current is correctly connected.
- Yes ↓

Connect the multimeter to terminals 14 and 16. Is the voltage 21.6—26.4 VAC?
- No → Investigate possible faults in the power supply.
- Yes ↓

Channel A

Connect the multimeter to terminals 17 and 18. (NOTE! Correct polarity ±.) Is the voltage 10.8—12 V?
- No → Check the supply voltage. Contact a Flygt service shop.
- Yes ↓

Disconnect the leakage sensor. Does pilot lamp 51 light?
- No → Contact a Flygt service shop.
- Yes ↓

Connect a resistor, 330 Ω 1/2 watt (or a reference sensor) between terminals 17 and 18. Does the pilot lamp 51 go out?
- No → Contact a Flygt service shop.
- Yes ↓

Is A alarm activated after about 5 seconds?
- No → Contact a Flygt service shop.
- Yes ↓

Channel B

Connect the multimeter to terminals 19 and 20. (NOTE! Correct polarity ±.) Is the voltage 10.8—12 V?
- No → Check the supply voltage. Contact a Flygt service shop.
- Yes ↓

Disconnect the sensor and the RUN-switch, Does the pilot lamp 52 light?
- No → Contact a Flygt service shop.
- Yes ↓

Connect a resistor, 330 Ω 1/2 watt (or a reference sensor) between terminals 19 and 20. Does the pilot lamp go out?
- No → Contact a Flygt service shop.
- Yes ↓

Is B alarm activated within 5 seconds?
- No → Contact a Flygt service shop.
- Yes ↓

Disconnect the resistor (or reference sensor). Reset B alarm. Activate the RUN function by jumpering 24 and 25. Is B alarm activated after about 30 seconds?

No → Contact a Flygt service shop.

Yes ↓

Channel C

Disconnect the sensor from terminals 26 and 27. Is C alarm activated?

No → Contact a Flygt service shop.

Yes ↓

Can C alarm be reset manually?

Yes → Contact a Flygt service shop.

No ↓

Connect a resistor, 680 Ω or 820 Ω (or a jumper), between terminals 26 and 27. Can C alarm be reset manually?

No → Contact a Flygt service shop.

Yes ↓

Channel D

Connect an ammeter to terminals 31 and 32 (NOTE! Correct polarity ±). Depress switch 58. The instrument shall now indicate the set alarm level (from the factory, set for 100°C (212°F), which corresponds to 10 mA).
For test of the channel D alarm function, the instrument shall indicate 7—14 mA.
Adjust if necessary with potentiometer 60.

↓

Turn off the supply current. Disconnect the sensor from terminals 28, 29 (and 30). Connect a jumper between 29 and 30. Connect a resistor 130 Ω between terminals 28 and 29. Turn the supply current back on. Does the instrument indicate about 5.5 mA?

No → Contact a Flygt service shop.

Yes ↓

Turn off the supply current. Substitute a 150 Ω resistor for the 130 Ω resistor. Turn the supply current on. Does the instrument indicate about 16 mA?

No → Contact a Flygt service shop.

Yes ↓

Is D alarm activated and cannot be reset?

No → Contact a Flygt service shop.

Yes ↓

Σ-alarm

Is Σ alarm activated every time another alarm is activated? — No → Contact a Flygt service shop.

Yes ↓

Alarm outputs

Is the equipment (e g pilot lamps) connect to the alarm outputs activated when the appropriate alarm is activated during fault tracing? — No → Contact a Flygt service shop.

Yes ↓

Interlock circuit

During normal operation: is pilot lamp 59 lit and is the circuit between terminals 11 and 12 closed? — No → Contact a Flygt service shop.

Yes ↓

At alarm: does pilot lamp 59 go out? — No → Contact a Flygt service shop.

Yes ↓

At alarm: is the circuit between terminals 11 and 12 broken? — No → Contact a Flygt service shop.

VW

SECTION V

PROXIMITY SWITCHES

SCHMERSAL EN SERIES

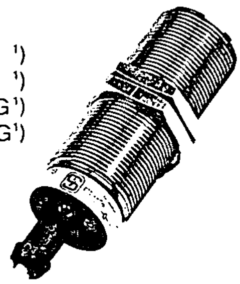
SUPPLIED BY NHP AUSTRALIA PTY LTD
25 TURBO STREET
COOPOOROO QLD 4151
TELEPHONE (07) 891 6008
FAX (07) 891 6139

Inductive Proximity Switches · Series IFL 10-30

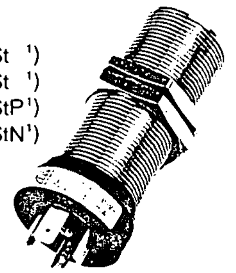
10 mm operating distance · shielded

EN Series

IFL 10-30-10zTG [1])
IFL 10-30-01zTG [1])
IFL 10-30-11zTPG[1])
IFL 10-30-11zTNG[1])



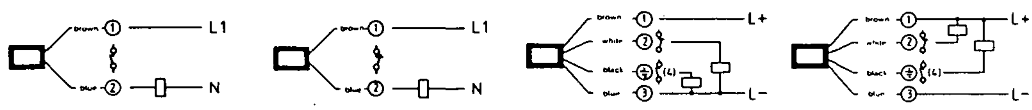
IFL 10-30-10ySt [1])
IFL 10-30-01ySt [1])
IFL 10-30-11yStP[1])
IFL 10-30-11yStN[1])



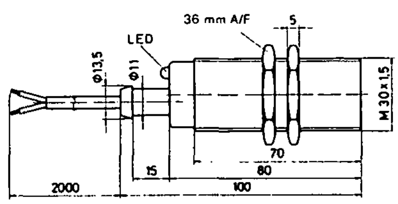
Technical Data:

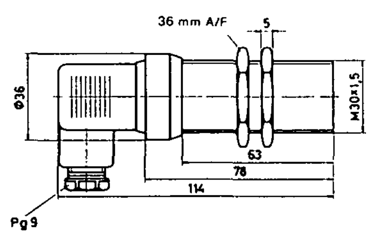
	Corresponds to standard EN 50 036 – A 34		Corresponds to standard EN 50 008 – A 14	
Series:	**IFL 10-30-10..**	**IFL 10-30-01..**	**IFL 10-30-11.P.**	**IFL 10-30-11.N.**
Voltage range, U_b:	90 ... 250 VAC		10 ... 30 VDC–P-type	10 ... 30 VDC–N-type
Sensing principle inductive:	2-wire		4-wire	
Rated operating distance, s_n:	10 mm, flush mountable			
Output function:	N.O.	N.C.	N.O. or N.C. (complementary)	
Supply frequency:	45–65 Hz			
Residual ripple:			≤ 10% as per DIN 41 755	
Output current, I_a:	max. 200 mA		max. 100 mA	
Inrush-current:	max. 1.25 A (10 ms)			
No-load current:	approx. 1.2 mA (110 VAC)		approx. 28 mA (24 VDC)	
Voltage drop, loaded, U_d:	approx. 8 V_{eff}		< 2 V	
Minimum load:	≥ 3 VA			
Protecteve circuit:	induction protection[4])		protected against wrong polarity connection and induction	
Voltage peaks:	max. 5 kV at Ri = 10 K up to 10 ms			
Operating frequency, f:	approx. 10 Hz		approx. 300 Hz as per EN 50 010	
Response time, t_E:	< 18 ms (220 VAC)	< 15 ms (220 VAC)	1.4 ms (24 VDC)	1.4 ms (24 VDC)
Attenuation range, s_r:	11 mm			
Test target size:	30 x 30 x 1 mm St 37 (mild steel)			
Effective operating distance, s_r:	s_n ± 10% at nominal voltage and nominal temperature			
Ultimate operating distance, s:	s_r ± 10% over tot. temperature and voltage range			
Switching hysteresis, H:	3–15% s_r			
Repeatability, R:	≤ 5% s			
Temperature range:	−25° C ... + 70° C			
Enclosure sealing:	IP 67 as per DIN 40 050 (IP 65 for plug)			
Housing:	brass sleeve + 2 nuts[2]), zinc plated and cromated; tightening torque for nuts max. 3000 Ncm (270 in. lbs.)			
Active surface symbol coleur:	green	yellow	red	blue
Connections:	cable HO3VV-F 2 X 0.5		cable LiYY 4 x 0.25 mm²	
	2 m long, permanently embedded with cable protector or plug connector type GDM ... [3])			

Connection diagram:



[1]) With LED function indicator as standard.
[2]) Instead of nuts, mounting clamp H 30 can be supplied (see page I-56).
[3]) Accessories see page I-56.
[4]) Upon request: short circuit and overload protected (index K) I_A = max. 100 mA, U_d = approx. 15 V (100 mA).





Mating connector can be supplied on request at additional cost[3]).

Take part number from the above photos in the same sequence.

SECTION W

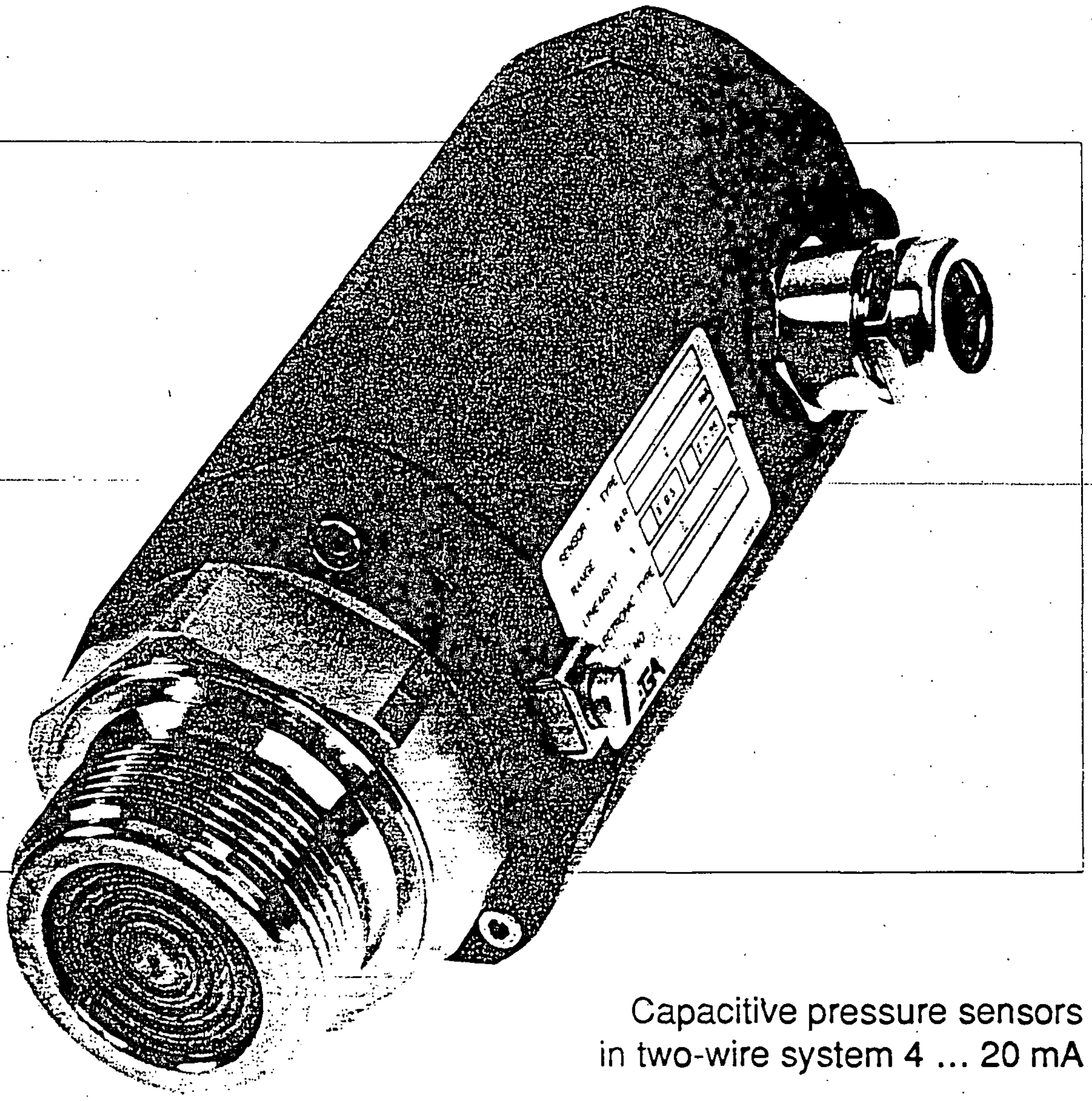
LEVEL INDICATING SYSTEM
VEGA TYPE D37

CLIENT FREE ISSUE

VEGA

TIB • Technical Information • Operating Instructions

Pressure sensor Type D33..., D34...
Type D35..., D36...
Type D37..., D38...



Capacitive pressure sensors in two-wire system 4 ... 20 mA

for continuous measurement of liquids
Integrated oscillator in two-wire system, floating
Current output 4 ... 20 mA

VEGA

Application

VEGA-pressure sensors are used in conjunction with remote evaluation instruments and are suitable for continuous level measurement or level detection.

All pressure sensors are available with special measuring ranges.

For the use in hostile environments types D 33 and D 34 are especially suitable. The series D 34 is designed for increased material temperatures.

Special versions are available for the measurement of aggressive products.

Configuration

Pressure sensor D33... consists of:

- mounting boss, bolting, flange, conus or TRI-clamp connection
- special steel housing with fixed special cable
- integrated oscillator type E25 or E25 B with integrated overvoltage arrester with adjustment facility in separate housing with pressure compensation facility, protection IP 65

Pressure sensor D34... consists of:

- mounting boss, bolting, flange, conus or TRI-clamp connection
- special steel housing with fixed special cable
- heat sink
- integrated oscillator type E25 with adjustment facility in separate housing with pressure compensation facility, protection IP 65

Pressure sensor D35... consists of:

- mounting boss, bolting, flange, conus or TRI-clamp connection
- Al-housing with pressure compensation facility
- integrated oscillator type E24 with adjustment facility

Pressure sensor D36... consists of:

- Al-housing with pressure compensation facility and mounting boss
- PTFE-suspension hose and transducer
- integrated oscillator type E24 with adjustment facility

Pressure sensor D37... consists of:

- transducer
- cable with straining clamp
- integrated oscillator type E25 or E25 B (only for D 37 H) with integrated overvoltage arrester with adjustment facility in separate housing with pressure compensation facility, protection IP 65

Pressure sensor D38... consists of:

- Al-housing with pressure compensation facility and mounting boss
- extension tube and transducer made of material no. 1.4571 (stainless steel)
- integrated oscillator type E24 with adjustment facility

A measuring system with pressure sensor D33..., D34..., D35... or D37... consists of:

- pressure sensor with oscillator
- power supply, not included in this system

Function

The diaphragm transforms the hydrostatic pressure of the product into a mechanical movement (max. 0,3 mm).

This movement is transmittted via a plunger-type capacitor, the capacitance of which changes proportional to the pressure (level).

The incorporated oscillator with adjustment facility converts this capacitance change into a DC-signal 4 ... 20 mA.

VEGA

Technical data

Output: adjustable	4 ... 20 mA
Supply voltage:	min. 12 ... max. 36 V DC
Floating voltage stability between housing and current output:	max. 500 V DC
Protection:	see schedule page 4
Protection class:	III
Permissible product temperature: D33..., D35...	–20 ... +100°C / –4 ... 212°F
Permissible product temperature: D34...	–20 ... +150°C / +200°C / –4 ... 302°F / 392°F (>150 ... 200°C / 302°F ... 392°F only with add. screening)
Permissible product temperature: D36..., D37..., D38...	–20 ... +80°C / –4 ... 176°F
Permissible ambient temperature on the housing or on the adjustment facility:	–20 ... +60°C / –4 ... 140°F
Storage and transport temperature:	–20 ... +70°C / –4 ... 158°F
Characteristics:	linear
Fault in characteristics incl. hysteresis and reproducibility:	≤0,35 % related to the used measuring distance
Longterm drift:	≤0,5 %/3 months related to the used measuring distance
Average temperature influence over the whole temperature range related to 20°C / 68°F:	≤2,5 %/100 K related to the used measuring distance
Max. pressure load:	15 times related to the max. measuring distance however max. 25 bar (355 psi)
Wetted parts:	material-no. 1.4571 (stainless steel) and Duratherm 600
Diaphragm material:	Duratherm 600 (special steel)
max. cable length: D33..., D34..., D37...	150 m / 492 ft.

Only screened cable should be used from the pressure sensor to the adjustment unit of the oscillator type E25.

Connection of pressure sensors see page 13.
All pressure sensors are available in the following measuring ranges.

Schedule of measuring range

Standard measuring ranges			Special measuring ranges		
Measuring range in bar / psi	max. measuring distance in bar / psi	min. measuring distance in bar / psi	Measuring range in bar / psi	max. measuring distance in bar / psi	min. measuring distance in bar / psi
0,1 / 1,42	0,1 / 1,42	0,025 / 0,355	–0,5...+0,5	1,0 / 14,2	0,25 / 3,55
0,2 / 2,84	0,2 / 2,84	0,05 / 0,71	–1,0...+0,0	1,0 / 14,2	0,25 / 3,55
0,4 / 5,68	0,4 / 5,68	0,1 / 1,42	–1,0...+1,5	2,5 / 35,5	0,625 / 8,9
1,0 / 14,2	1,0 / 14,2	0,25 / 3,55	–1,0...+4,0	5,0 / 71,0	1,25 / 17,8
2,5 / 35,5	2,5 / 35,5	0,625 / 8,87	–1,0...+10	11 / 156,2	2,75 / 39,1
5,0 / 71	5,0 / 71	1,25 / 17,75	–1,0...+16	17 / 241,4	4,25 / 60,4
10 / 142	10 / 142	2,5 / 35,5	*Attention:* In closed pressure systems fluctuations of the atmospheric pressure are received as measuring faults (approx. 20 mbar)		
16 / 227,2	16 / 227,2	4,0 / 56,8			

VEGA

	D33 G	D33 R	D33 F	D33 K	D33 A	D33 C	D34 G	D34 R	D34 F	D34 K	D34 A	D34 C	D35 G	D35 R	D35 F	D35 K	D35 A	D35 C
Oscillator type E24													•	•	•	•	•	•
Oscillator type E25	•	•	•	•	•	•	•	•	•	•	•	•						
Oscillator type E25 B	•	•	•	•	•	•												
Protection: housing IP 54													•	•	•	•	•	•
Fixed special PE-connection cable (IP 68)	•	•	•	•	•	•	•	•	•	•	•	•						
Mounting parts:	Material-no. 1.4571 (stainless steel)																	
Mounting boss 1 1/2" BSP	•						•						•					
Bolting DN 40 DIN 11 851		•						•						•				
Flange DN 40 PN 40			•						•						•			
Conus DN 40 with pressure screw, sealing				•						•						•		
Pressure flange					•						•						•	
TRI-Clamp 2"-connection acc. to ISO 2852						•						•						•
Increased material temperature –20 ... +150°C / –4 ... 302°F							•	•	•	•	•	•						
Weight in kg approx.	1,6	1,7	3,3	1,7	2,4	1,5	1,8	1,9	3,5	1,9	2,6	1,7	1,9	2,0	3,6	2,0	2,7	1,8
Special versions																		
Increased protection IP 67 fixed special PE-connection cable													•	•	•	•	•	•
Accessories and mounting material not included																		
Welded socket for bolting		•						•						•				
Welded flange with conus				•						•						•		
2" ring with sealing						•						•						•

Pressure sensor for vertical mounting	D36 G	D37 G	D37 H	D38 G
Oscillator type E24	•	•		•
Oscillator type E25			•	
Oscillator type E25 B			•	
Protection: housing IP 54	•	•		•
Fixed special OE-connection cable			•	
Mounting boss 1 1/2" BSP made of material no. 1.4571 (stainless steel)	•	•		•
Straining clamp for suspension			•	
PTFE-suspension hose max. length 20 m / 66 ft.	•			
Connection tube 28 x 1,5 of material no. 1.4571 (stainless steel) length min.: 500 mm/1,7 ft., max.: 4000 mm/13,2 ft. Weight per metre: approx. 1 kg				•
Weight in kg approx.	3,6	3,4	1,8	3,9
Special versions				
Fixed special PE-connection cable for increased protection IP 67	•	•		•
PE-plastic coating	•	•	•	

Flange dimensions for types D33 F, D34 F, D35 F

DIN flanges

PN 40	D	k	Number of holes	d1	d2	b
DN 40	150	110	4	90	18	18
DN 50	165	125	4	102	18	20
DN 80	200	160	8	138	18	22
DN 100	235	190	8	160	22	22

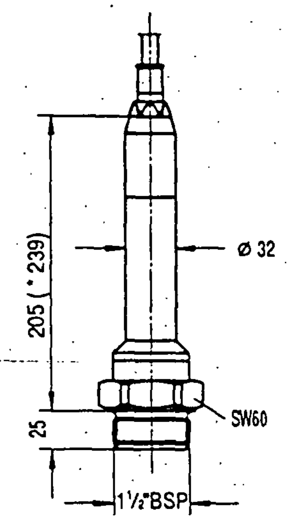
ASA flanges

Nominal pressure 150 lbs	D	k	Number of holes	d1	d2	b
ASA 2 in	152,4	120,7	4	90	19,1	18
ASA 3 in	190,5	152,4	4	125	19,1	22
ASA 4 in	228,6	190,5	8	160	19,1	22

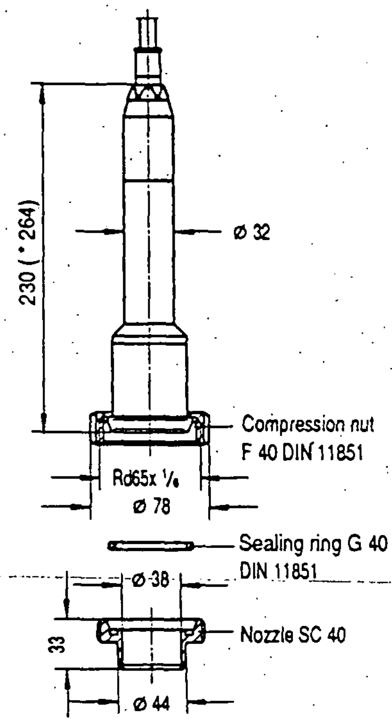
VEGA

Dimensional drawing

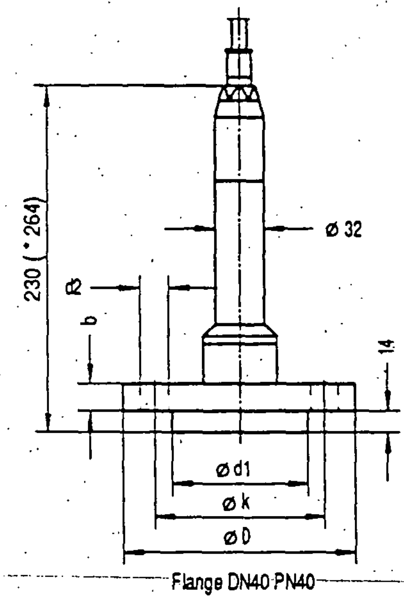
D33 G



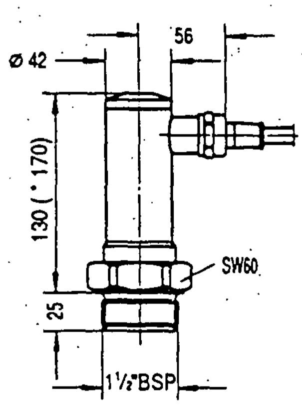
D33 R



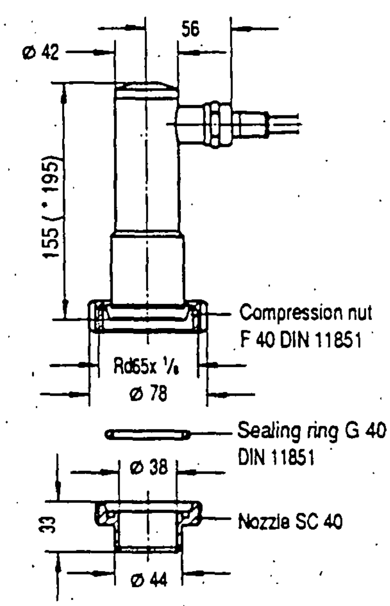
D33 F



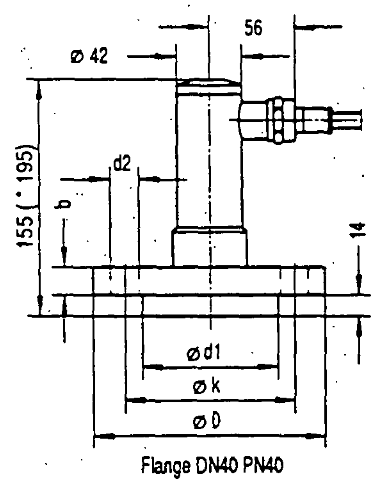
Lateral cable outlet



Lateral cable outlet



Lateral cable outlet

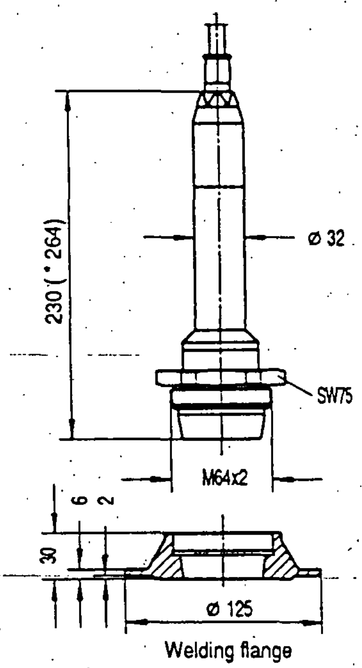


- This dimension is only valid in conjunction with oscillator type E25 B.

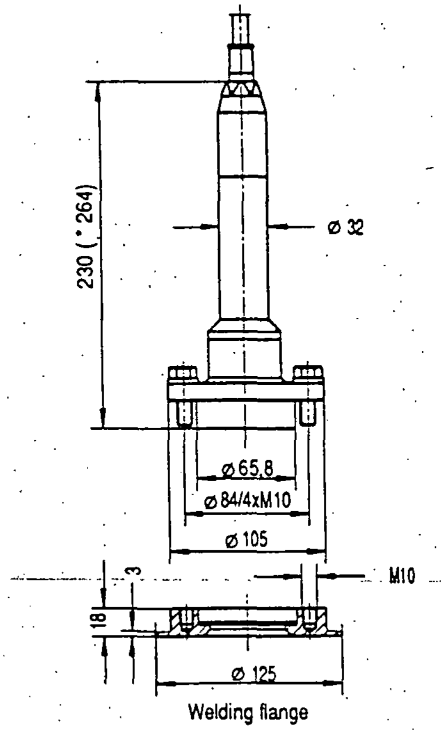
Flange dimensions see page 4

VEGA

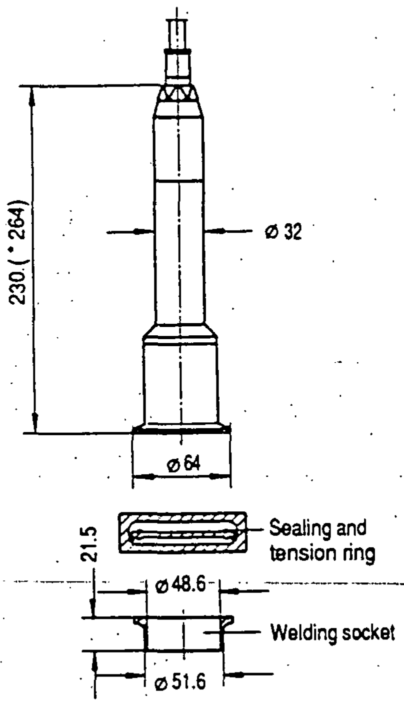
D33 K



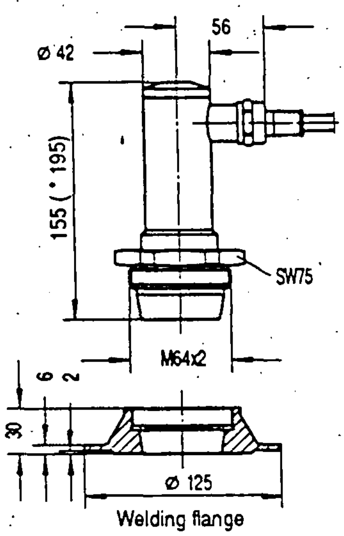
D33 A



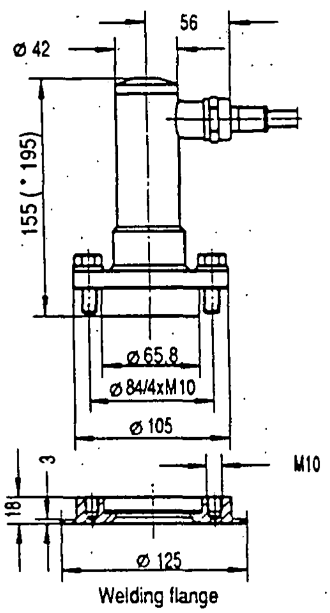
D33 C



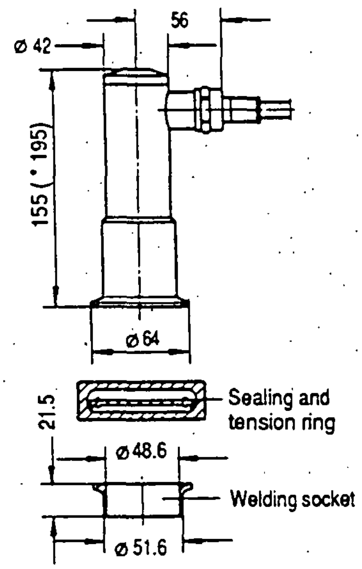
Lateral cable outlet



Lateral cable outlet



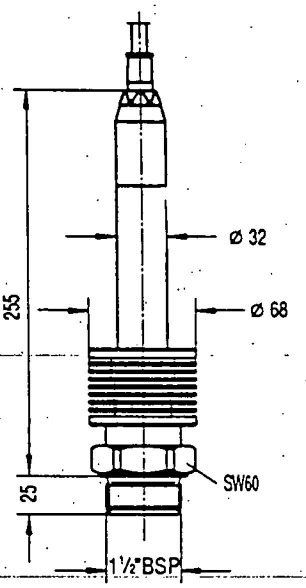
Lateral cable outlet



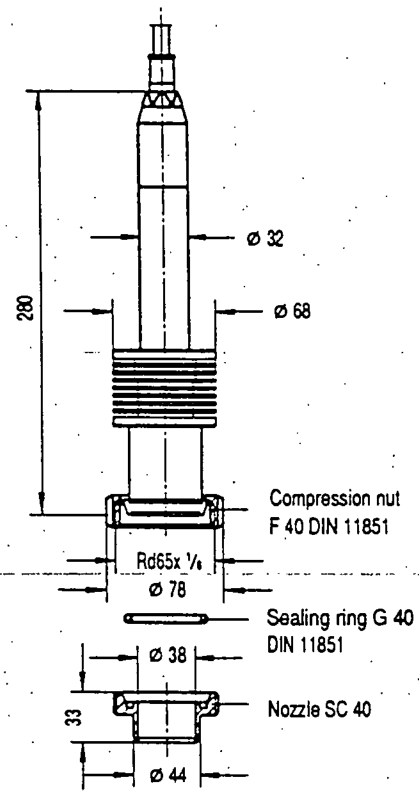
- This dimension is only valid in conjunction with oscillator type E25 B.

VEGA

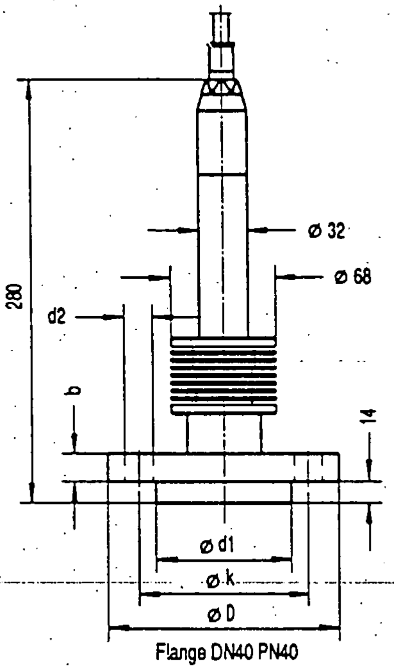
D34 G



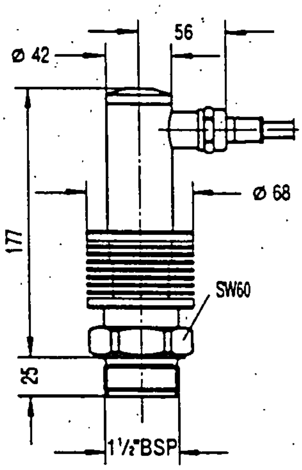
D34 R



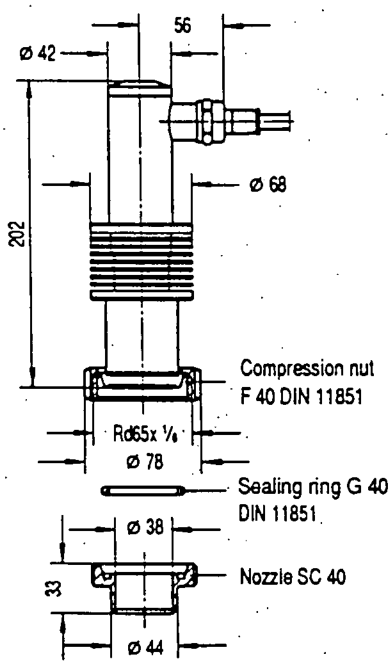
D34 F



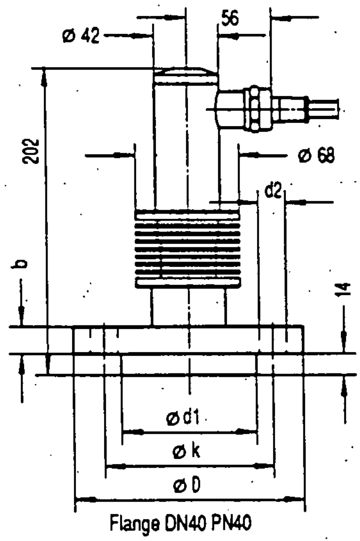
Lateral cable outlet



Lateral cable outlet



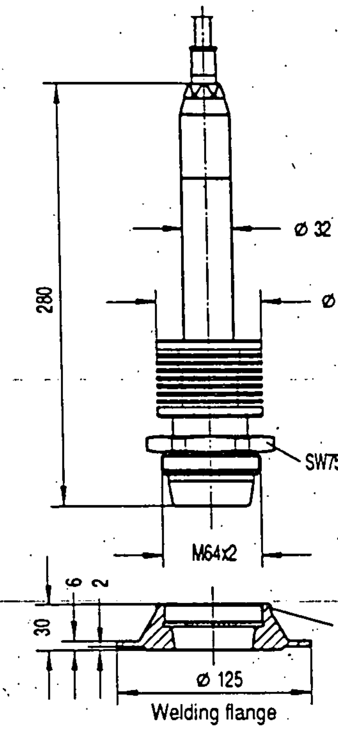
Lateral cable outlet



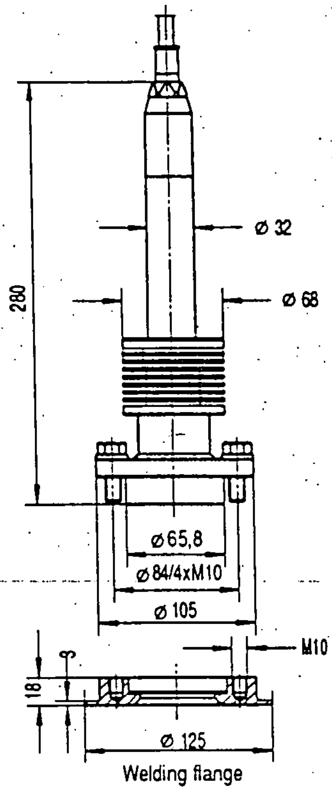
Flange dimensions see page 4

VEGA

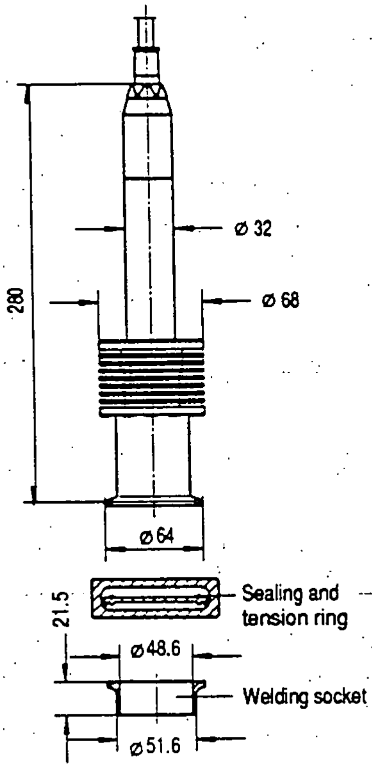
D34 K



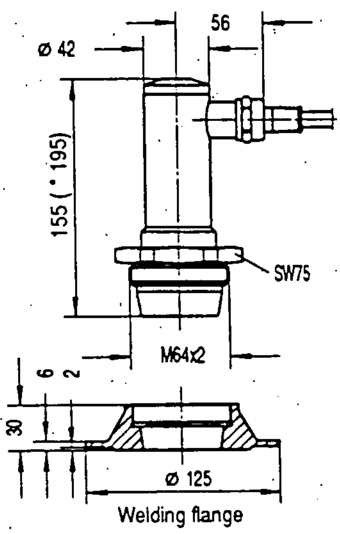
D34 A



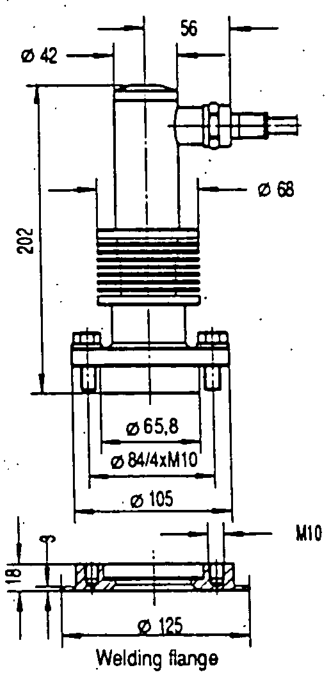
D34 C



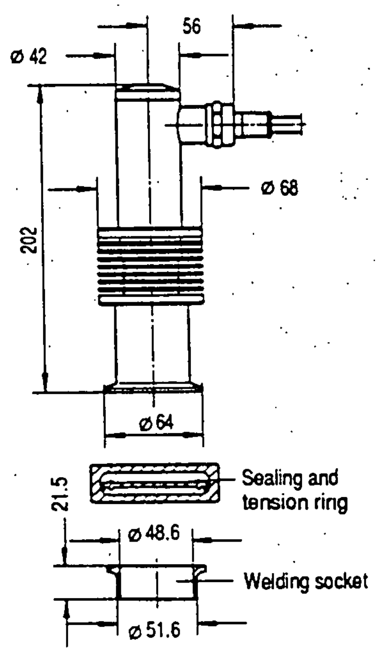
Lateral cable outlet



Lateral cable outlet

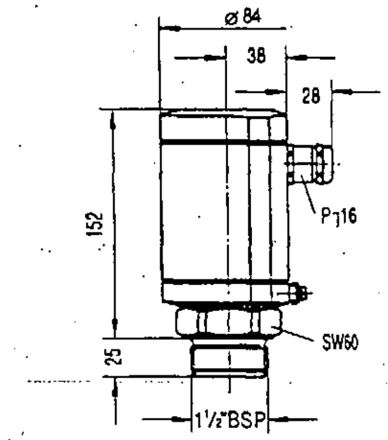


Lateral cable outlet

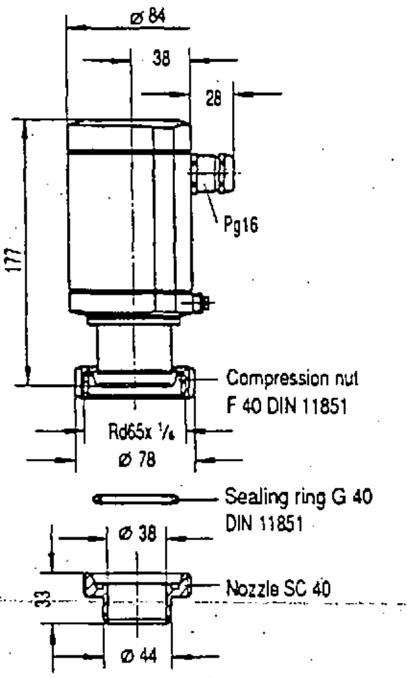


VEGA

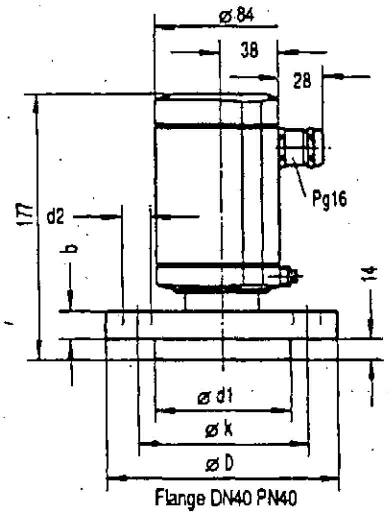
D35 G



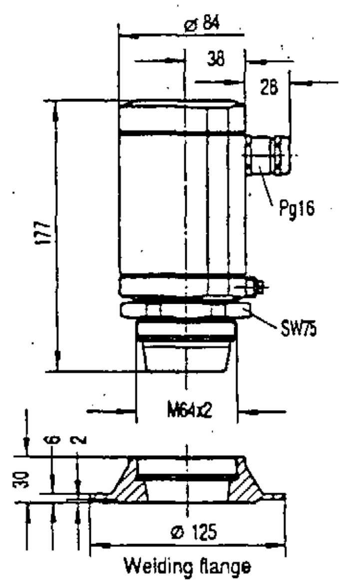
D35 R



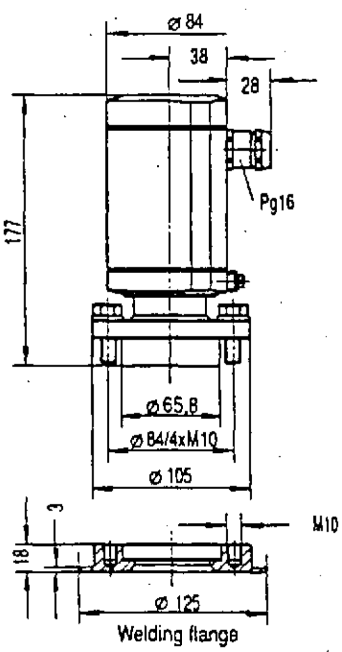
D35 F



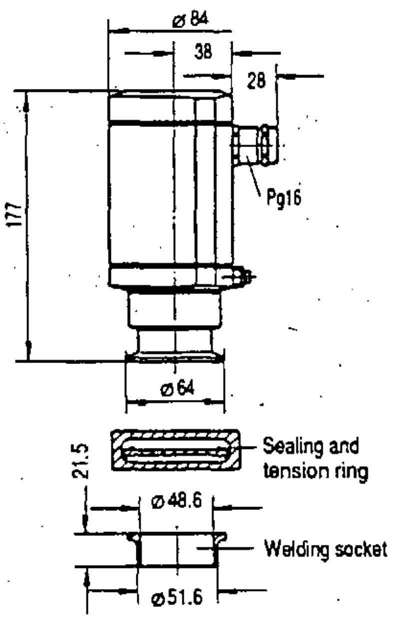
D35 K



D35 A

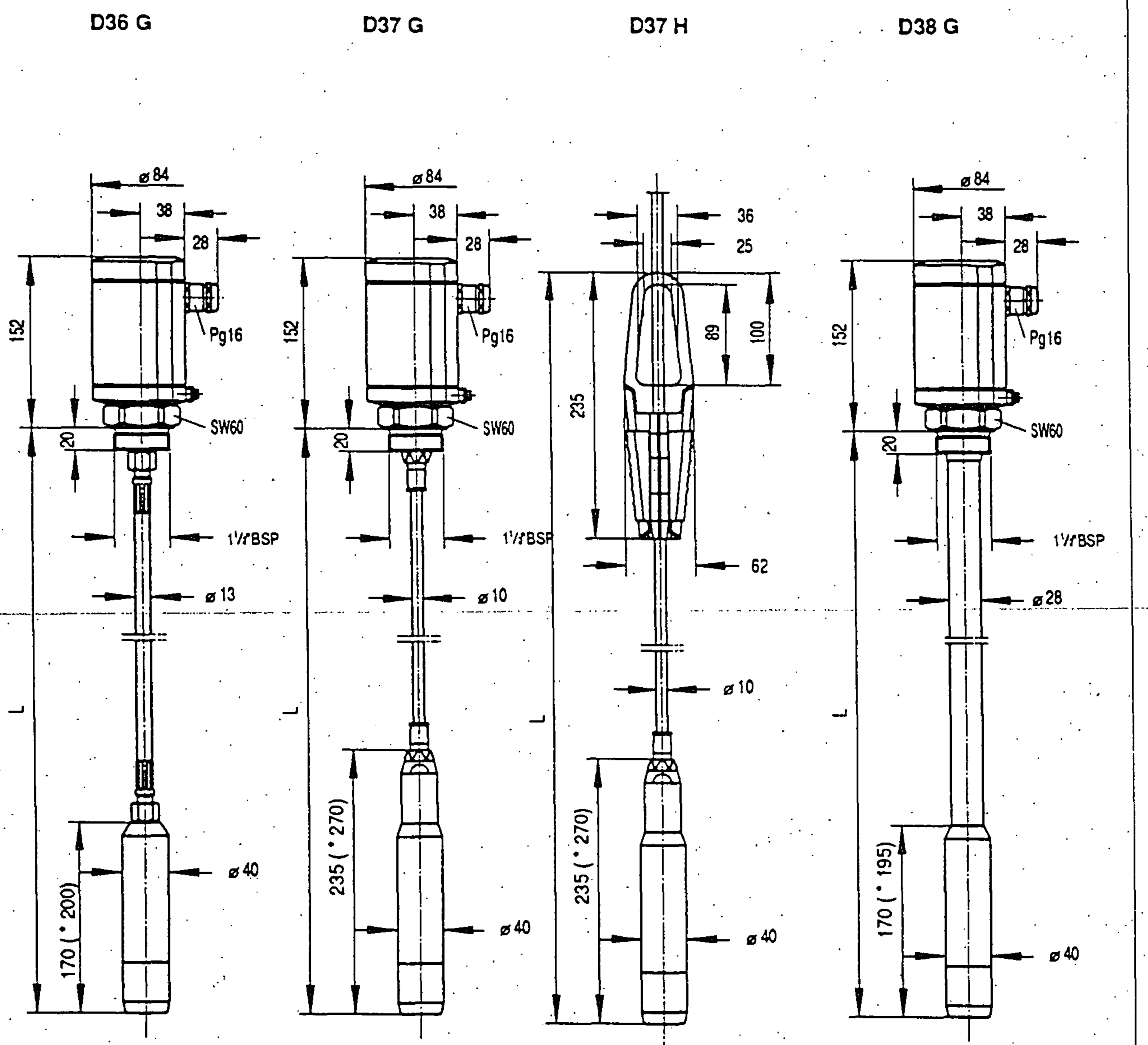


D35 C



Flange dimensions see page 4

VEGA



• This dimension is only valid in conjunction with oscillator type E25 B.

Mounting instructions

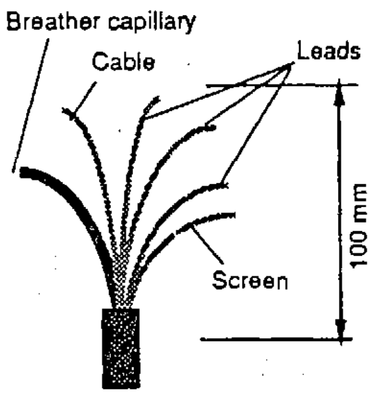
Attention:
All pressure sensors include a breather to allow an atmospheric pressure onto the backside of the diaphragm.

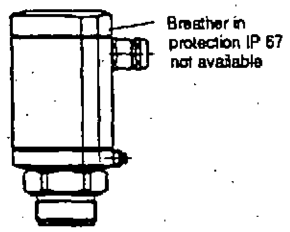
The following items should be observed when using pressure sensors with fixed connection cable:

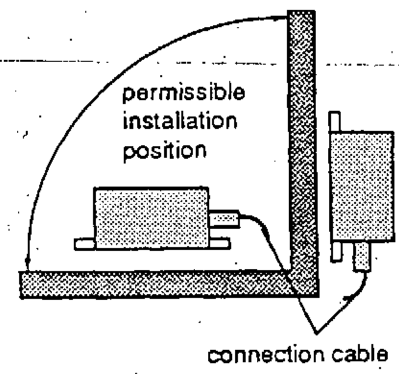
- dismantle the cable (see drawing)
- the breather capillaries should be clean cut
- the connection housing should be allowed to breath to atmosphere
- insert the cable into the connection housing acc. to drawing
- on pressure sensors without fixed connection cable the breather is located in the cover of the housing
- it should be observed that this opening is free
- *Attention:*
  it is essential that the screening of the pressure sensor is earthed

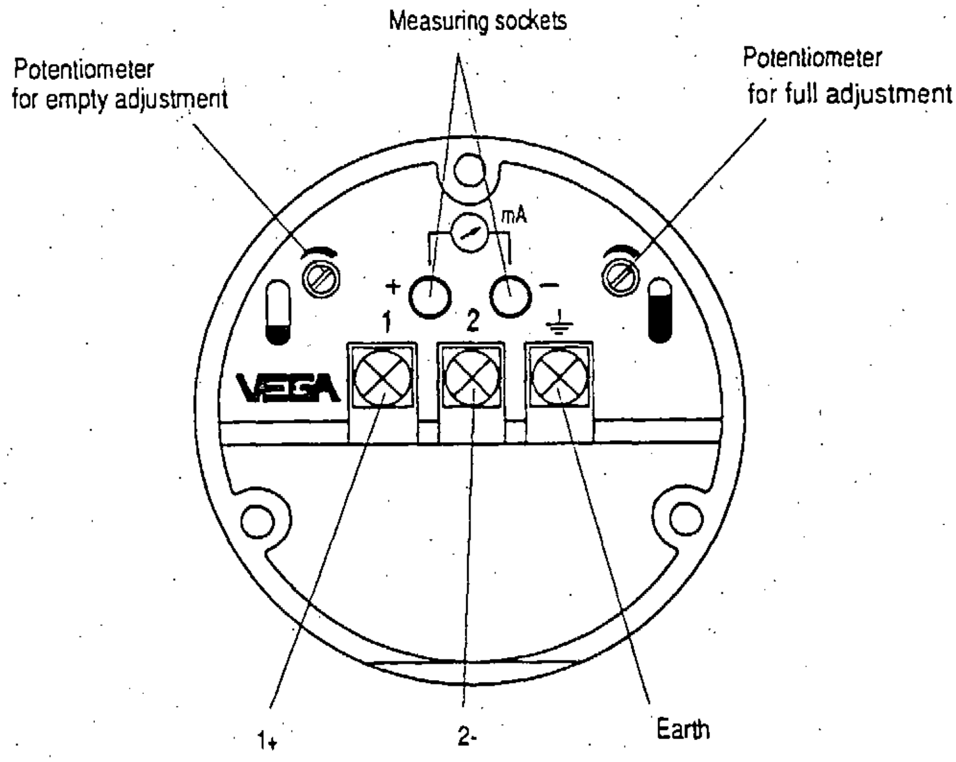
The connection housing should only be mounted in the positions indicated on the drawing, to avoid water ingress.

With types D35 ... the housing can be turned manually after mounting. Therefore the cable entry can be adjusted to the required position.









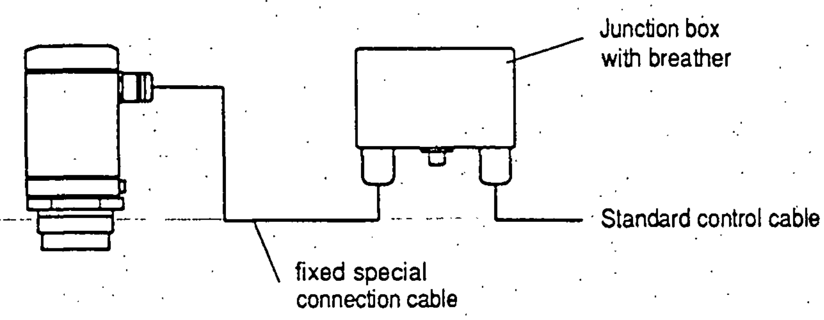
VEGA

For pressure sensor type D35..., D36... and D38... in protection IP 67, with oscillator type E24 and fixed special connection cable only the connection housing with pressure compensation facility (protection IP 64) should be used. The connection housing is not included (ref. no. 101 009).

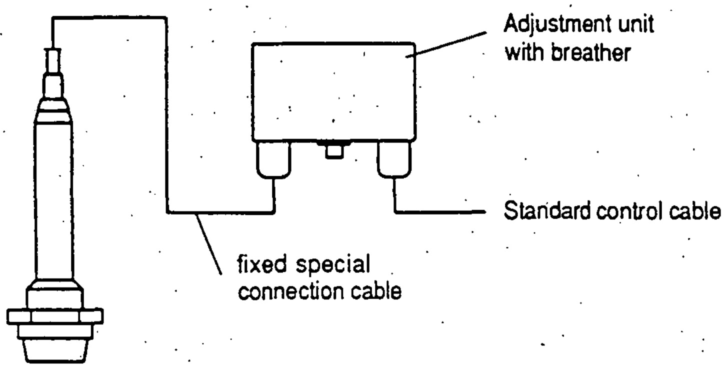
For pressure sensor type D33..., D34... und D37... screened cable should be used to lengthen the fixed special connection cable to the adjustment facility.

The housing with breather should be mounted to the connection position.

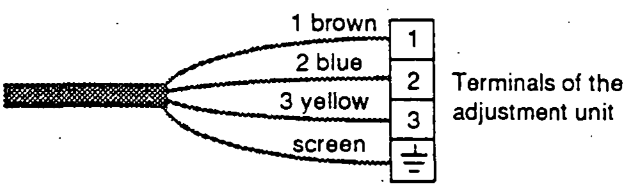
Pressure sensor with oscillator type E24
without breather protection IP 67



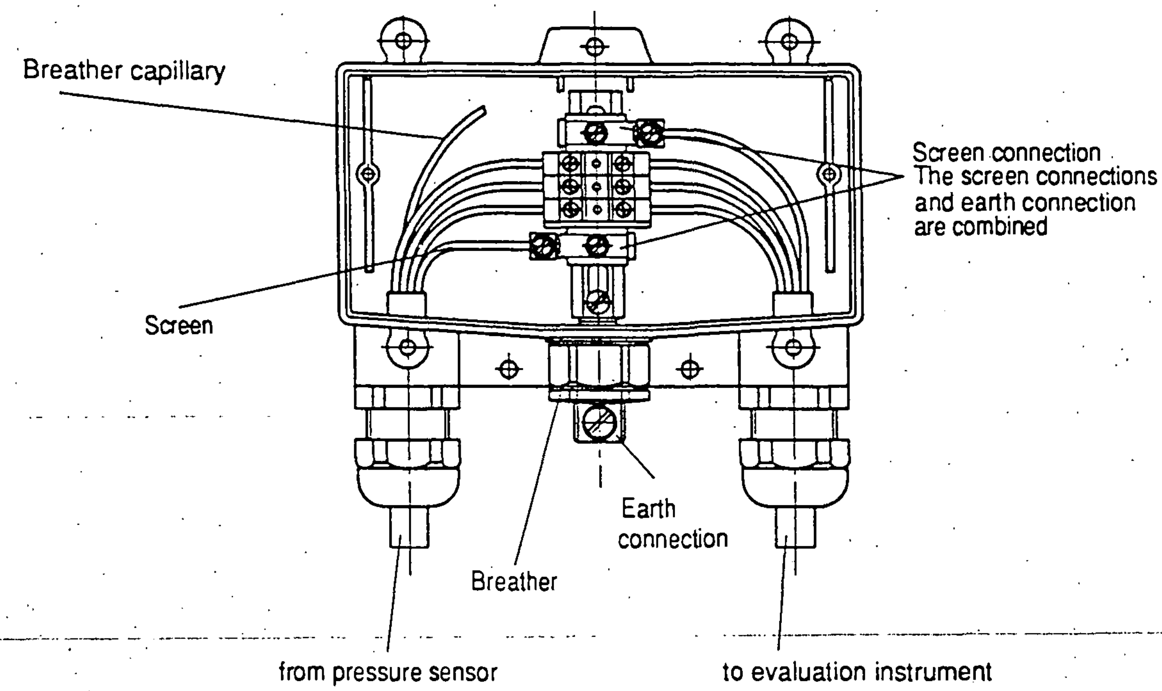
Pressure sensor with oscillator type E25



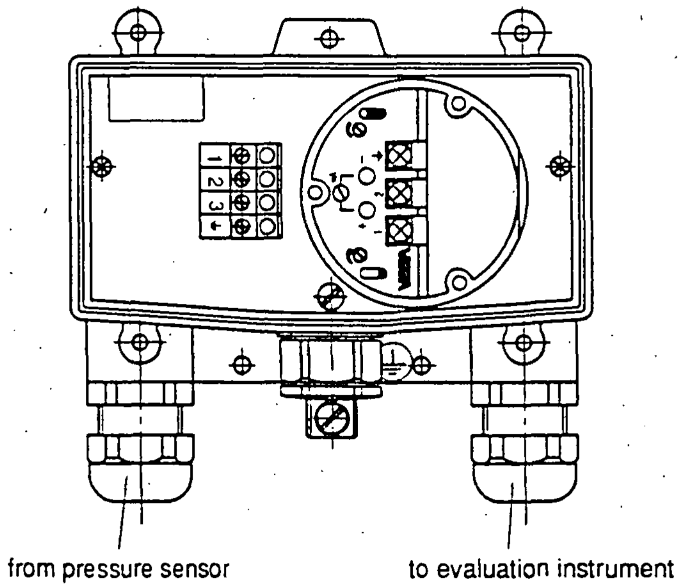
Cable from pressure sensor



Connection housing



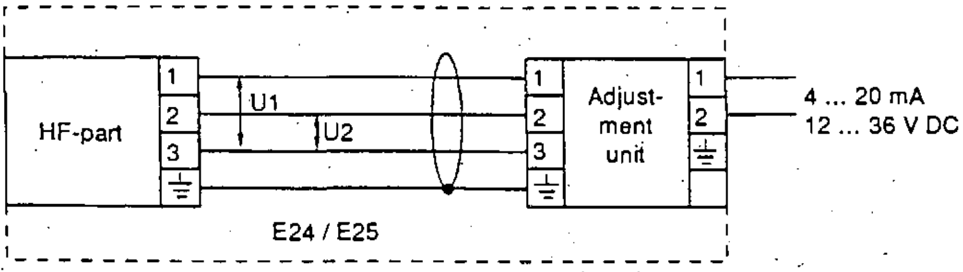
AAdjustment unit oscillator type E25 and E25 B



If oscillator type E25 B is used as overvoltage protection, the oscillator in the pressure sensor as well as the adjustment unit (up to terminals 1, 2 and 3) are protected.

The 4 - 20 mA output can be additionally protected by overvoltage arresters type B 62 - 36, see TIB overvoltage arresters.

Voltage and current values



U1 = 8,3 V DC, I approx. 1,5 mA
U2 = 4 – 5 V DC independent of pressure

Start-up

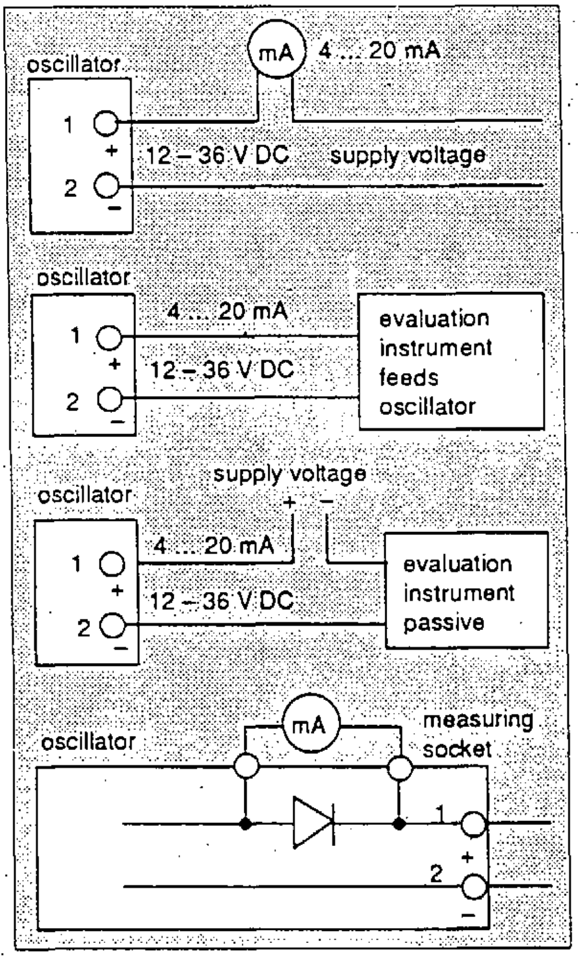
For the start-up a meter (measuring range 0 ... 20/30 mA) can be connected locally to the measuring sockets, Ri = max. 20 Ohms.

Empty adjustment
Lower the product to min. level. Connect the meter to the measuring sockets and adjust a current of 6 mA by means of the potentiometer for empty adjustment. Turn the potentiometer for full adjustment to the right until the current does not increase anymore. Then adjust a current of 4 mA by means of the potentiometer for empty adjustment.

Full adjustment
Fill product to max. level. Adjust the potentiometer for full adjustment such that the meter indicates a current of 20 mA.

Adjustment of the measuring range
The measuring distance of the pressure sensor is adjusted on the oscillator by means of potentiometer for empty and full adjustment. It can be adjusted in a ratio from 1 : 1 to 4 : 1. The empty adjustment can be shifted by max. 30 % to the top.

Example: Measuring range of the pressure sensor 0 ... 1 bar / 0 ... 14,2 psi



Pressure at empty adjustment	Indication on the evaluation instrument	Current at the output of the pressure sensor	Pressure at full adjustment	Indication on the evaluation instrument	Current at the output of the pressure sensor
0 bar	0 %	4 mA	1 bar	100 %	20 mA
0 bar	0 %	4 mA	0,25 bar	100 %	20 mA
0,25 bar	0 %	4 mA	0,75 bar	100 %	20 mA
0,30 bar	0 %	4 mA	1 bar	100 %	20 mA

0,25 bar / 3,55 psi; 0,30 bar / 4,26 psi; 1 bar / 14,2 psi; 0,75 bar / 10,65 psi

VEGA

Fault finding

General test of the measuring system

In case of faulty indication, first check that the sensor is breathing to atmosphere.

- Check that the breather is clear on sensor housing
- On pressure sensors with extension cables ensure capillaries and junction boxed are clear of obstruction
- The reading on the remote amplifier should not change when the junction box or sensor housing is opened

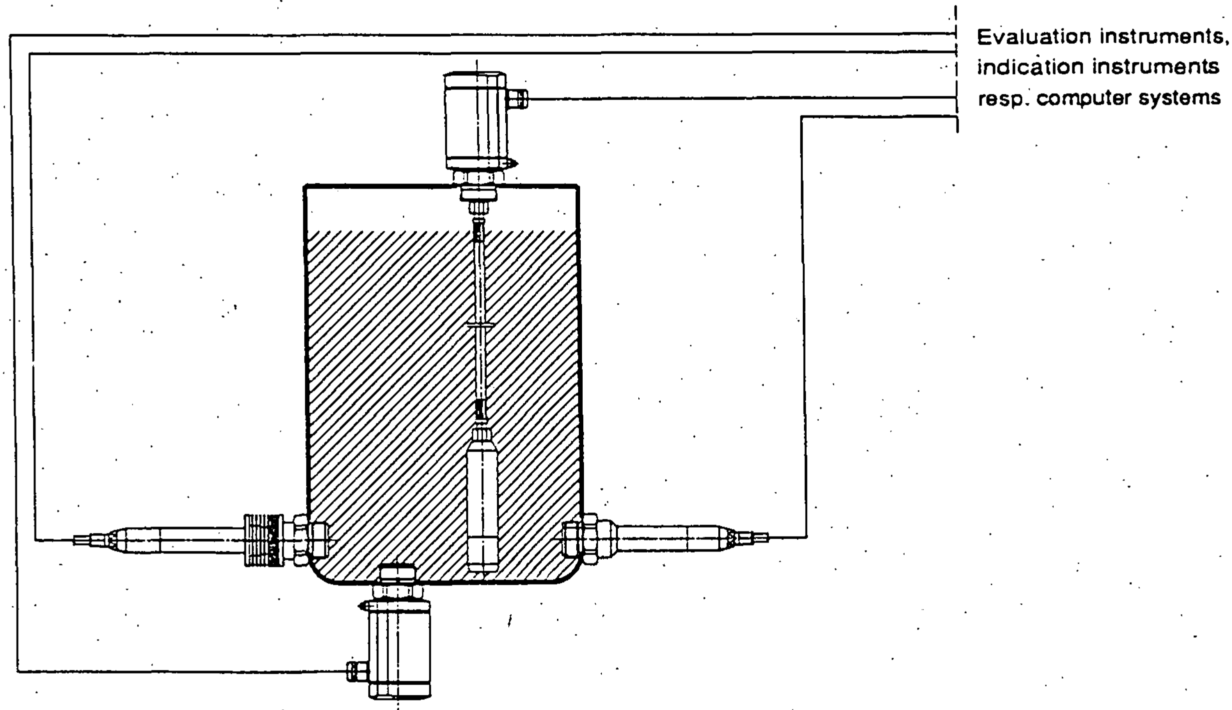
Electrical test of the measuring system
4 ... 20 mA two-wire system

- The initial current should be approx. 4 mA when the diaphragm is covered

4 ... 20 mA	measurement is o.k. (current depends on the level)
< 3 mA	oscillator defect
0 mA	line break
> 25 mA	oscillator, pressure sensor defect or short-circuit

- The supply voltage for the electronics should be min. 12 V DC at max. measuring current on terminals 1 and 2

Examples



VEGA

Prüfzertifikat für Druckaufnehmer
Test certificate for pressure sensors
Certificat de contrôle pour capteurs de pression

Adresse • Address • Adresse	
VEGA Australia P/L 17 Clearview Place BROOKVALE N.S.W. 2100	Auftrags-Nummer / Order no. / No. de commande: 561639/313
	Ihre Kom.-Nr. / Your com. no. / Votre No de Cde.: VS-905
	Kennzeichnungs-Nr. / Identification no. / No. d'identification:

Druckaufnehmer Typ / Pressure sensor type / Capteur de pression type		Ident-Nr. / Ident no. / No. de code	Serien Nr. / Series no. / No. de série
	D37 H	1428.40	52745
Zulassungen / Approvals / Agréments			

Elektronik-Einsatz Typ / Oscillator type / Préamplificateur type		Serien Nr. / Series no. / No. de série
	E 25	10238151

Kennlinienfehler / Fault in characteristics / Erreur de caractéristique	zul. Fehler / Perm. error / Erreur admise	Meßbereich / Measuring range / Plage de mesure
0.12 %	0.35 %	0 – 1 bar

Ref.-Druck bar / Ref. pressure bar / Pression de réf. bar	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875	1.000
Ausgang mA / Output mA / Sortie mA	4.013	6.029	8.036	10.037	12.036	14.029	16.018	18.002	19.981
Fehler %	-0.12	+0.00	+0.07	+0.10	+0.12	+0.10	+0.06	-0.02	-0.12
Meßschritt mA	2.016	2.007	2.001	1.999	1.993	1.989	1.984	1.979	

Δ 15.968 mA

Temperatureinfluß / Temperature influence / Dérive thermique	Bezogen auf die maximale Meßspanne Gemittelt über den gesamten Temperaturbereich Bezugstemperatur 25°C	zul. Fehler / Perm. error / Erreur admise: 2.5 %	Bemerkungen / Notes / Remarques

- Schutzart IP 67 / Protection IP 67 / Protection IP 67
- Kunststoffüberzug / Plastic coating / Revêtement en matière plast.
- Kabellänge / Cable length / Longueur de câble: 20 m
- Auswertgerät / Evaluation instrument / Transmetteur
- Differenzdruckmessung mit Serien-Nr. / Differential pressure meas. with series no. / mesure de différence de Pression avec N° de Serie

Caswell St.

	Datum • Date	Unterschrift • Signature
VEGA Grieshaber GmbH & Co • Am Hohenstein 113 Postfach 11 42 • 7622 Schiltach/Schwarzwald Telefon 07836/50-0 • Teletex (17) 783621 • Telefax 07836/50201	24.03.1993	

XYZ

SECTION X

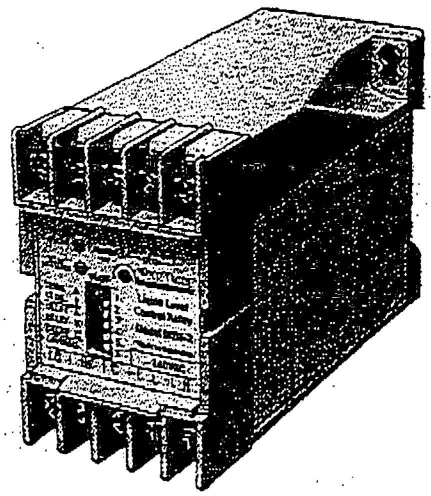
LEVEL DETECTION SYSTEM

MULTIRODE TYPE

SUPPLIED BY: BEP ENGINEERING PRODUCTS
123 BOUNDARY STREET
WEST END QLD 4101
TELEPHONE: (07) 844 1711
FAX: (07) 844 8878

MULTI TRODE DATA SHEET BEP
BEP ENGINEERING PRODUCTS

MTR LIQUID LEVEL RELAY



AUSTRALIAN MADE

- **Safe extra low voltage sensing**
- **Charging or Discharging**
- **4 Sensitivities**
- **8 Activation delays**
- **Dip switch programmable**
- **Proven reliability**
- **Power and activation LEDs**

METHOD OF OPERATION

The Multi Trode MTR Liquid Level Relay is a conductive liquid level control device which when used with the Multi Trode multi-sensored or single-sensored probe, enables dual point activation/deactivation of pumps, alarms and other monitoring and control equipment.

The relay senses the liquid via a safe extra low voltage signal and latches. This state is maintained until the circuit is broken when the liquid passes the selected stop sensor. The relay then resets for the next operation.

Operation of the MTR Liquid Level Relay set for CHARGING
With the relay function switch set for charging, the relay is activated when the liquid falls below the selected low sensor. Contact #15 #16 changes over to #15 #18, the electrically separate open contact #25 #28 closes and the yellow LED is illuminated.

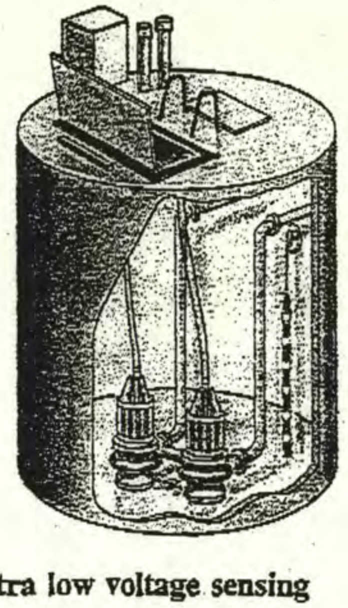
The relay is maintained in this state until the liquid reaches the selected high sensor and then is deactivated. It is now reset and ready for the next operation.

Operation of the MTR Liquid Level Relay set for DISCHARGING
With the relay function switch set for discharging, the relay is activated when the liquid reaches the selected high sensor. Contact #15 #16 changes over to #15 #18, the electrically separate open contact #25 #28 closes and the yellow LED is illuminated.

The relay is maintained in this state until the liquid falls below the selected low sensor and then is deactivated. It is now reset and ready for the next operation.

MULTI TRODE DATA SHEET BEP
BEP ENGINEERING PRODUCTS

MULTI SENSORED PROBES



AUSTRALIAN MADE

- **Safe extra low voltage sensing**
- **Proven reliability in many countries**
- **Unaffected by fat and debris**
- **Unaffected by froth and turbulence**
- **Simple installation from outside pit**
- **Positive pump cut out**
- **Very low maintenance**
- **Easy level selection**
- **Low installed cost**

Multi Trode has proven to be the most reliable cost effective liquid level control system available.

INTRODUCTION TO MULTI TRODE

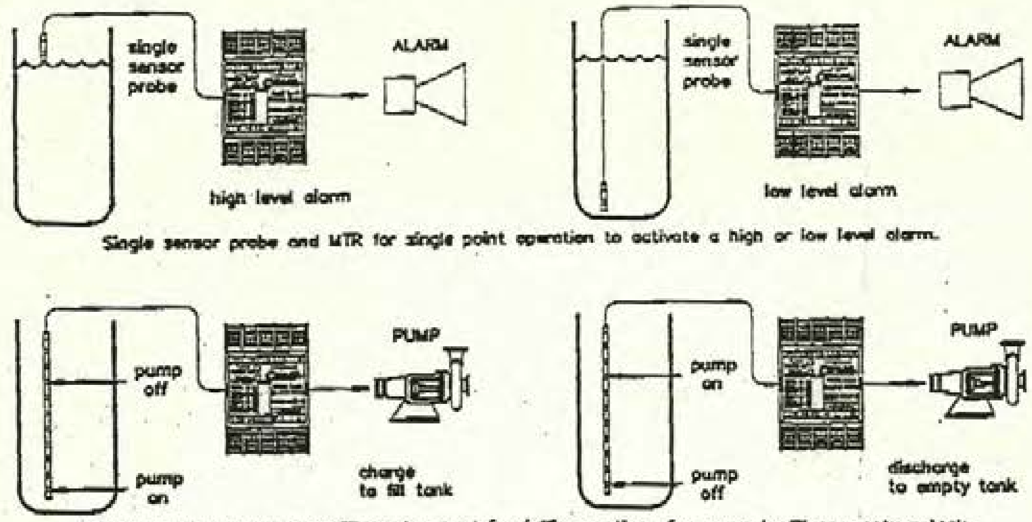
The Multi Trode liquid level system is a conductance activated control system untilizing the electrical conductivity of the liquid to carry a small current which when sensed, activates the controller.

The one piece, multi-sensored probe is central and essential to the effectiveness of the Multi Trode system. The patented design probe provides easc of installation, simple adjustment, long term reliability, and freedom from the effects of fouling and turbulence.

PROVEN RELIABILITY

Multi Trode probe systems have been operating effectively in sewerage wet wells since 1980 and they are now used by over 1200 water and sewerage authorities in Australia, USA, Japan, Europe and the Asian Pacific region.

APPLICATIONS OF THE MTR



Single sensor probe and MTR for single point operation to activate a high or low level alarm.

Multi sensored probe and MTR for two level (on/off) operation of a pump to fill or empty a tank.

MTR SPECIFICATIONS

SENSOR VOLTAGE	12VAC NOMINAL
NUMBER OF OUTPUTS	2 SETS, 1 NO & 1 CHANGEOVER
CONTACT RATING	5 AMP 250VAC RESISTIVE
CONTACT LIFE	10^6 OPERATIONS
SUPPLY VOLTAGE (+-10%)	240, 110, 24VAC, 50/60Hz 24, 12VDC
POWER CONSUMPTION	3.4VA (MAX)
DIMENSIONS mm (inches)	H74(2.76) X W45(1.77) X D114(4.5)
TERMINAL SIZE mm (inches)	2 X 2.5mm²(0.64"INCH)
DISPLAY LEDS	GREEN - POWER ON RED - ACTIVATION
MOUNTING ARRANGEMENT	DIN RAIL OR 2X4mm SCREWS (5/16")
SENSITIVITY (OHMS)	SELECTABLE VIA SWITCHES 1k, 4k, 20k, 80k
MODE	SELECTABLE VIA SWITCHES CHARGE/DISCHARGE
ACTIVATION DELAYS (SECS)	SELECTABLE VIA SWITCHES 0, 2.5, 5, 10, 20, 40, 80, 160
WORKING TEMPERATURE C(F)	MINUS 10°C (+14°F) PLUS 60°C (140°F)

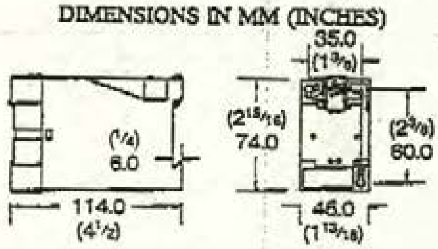
FUNCTION DIP SWITCHES

SWITCH Nº SETTING 1	2	SENSITIVITY	
OFF	OFF	1k Ω	Concentrated Acids, Minerals, Alkalines
OFF	ON	4k Ω	Acids, Alkalines, Diluted brine, Sea water
ON	OFF	20k Ω	Sullage, Sewage affluent Town water
ON	ON	80k Ω	Low conductive liquids, Purified water

3	4	5	DELAY ON ACTIVATION
OFF	OFF	OFF	Zero Seconds
OFF	OFF	ON	2.5 Seconds
OFF	ON	OFF	5 Seconds
OFF	ON	ON	10 Seconds
ON	OFF	OFF	20 Seconds
ON	OFF	ON	40 Seconds
ON	ON	OFF	80 Seconds
ON	ON	ON	160 Seconds

6	MODE
OFF	Discharge
ON	Charge

DIMENSIONS IN MM (INCHES)



ORDERING INFORMATION

MODEL MTR -☐

POWER SUPPLY

- 2–240VAC
- 3–110VAC
- 4–24VAC
- 5–24VDC
- 6–12VDC

MULTI TRODE PRODUCTS ARE PROTECTED BY A 2 YEAR WARRANTY

Multi Trode products are covered by International patents, including AU 588159, CAN 1253932, EUR 85905496.7, JAP 504912/1985, NZ 213599 and US 4739786

ULTITRODE DESIGNED AND MANUFACTURED BY SARTEK

BEP

New South Wales Office
Unit 12 & 13, Centre West
108 Silverwater Road
Silverwater NSW 2141
Tel: (02) 647 3700
Fax: (02) 748 3021

Victoria Office
9-10 Bastow Place
Mulgrave Vic 3170
Tel: (03) 561 7000
Fax: (03) 562 1322

South Queensland Office
123 Boundary Street
West End Qld 4101
Tel: (07) 844 1711
Fax: (07) 844 8878

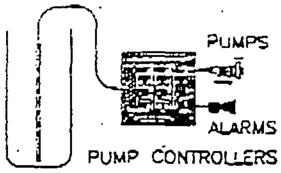
South Australia Office
1027 Port Road
Alberton SA 5014
Tel: (08) 47 2622
Fax: (08) 341 1360

West Australia
20 Hines Road
O'Connor WA 6163
Tel: (09) 337 4411
Fax: (09) 331 2774

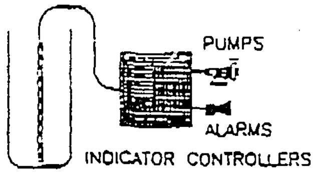
Tasmania Office
412 Brooker Highway
Derwent Park Tas 7009
Tel: (002) 72 4744
Fax: (002) 72 8599

North Queensland Road
46 Ingham Road
Townsville Qld 4810
Tel: (077) 72 2599
Fax: (077) 72 3925

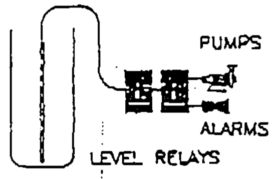
APPLICATIONS OF MULTI-SENSORED PROBES



LEVEL INDICATION CONTROL AND COMMUNICATIONS



LEVEL INDICATION AND CONTROL SIGNALS



LEVEL SIGNALS OR CONTROL

- SEWERAGE PUMP STATIONS
- EFFLUENT TANKS
- SULLAGE PITS
- WATER SUPPLIES
- HIGH RISE BUILDINGS
- FLOOD MONITORING
- INDUSTRIAL PROCESSES
- CHEMICAL PLANTS
- BOATS AND MARINE
- MINING

PROBE SPECIFICATIONS

CABLE
PURPOSE MANUFACTURED PVC/PVC MULTICORE INDIVIDUALLY NUMBERED

RESILIENT COMPRESSION FITTING

PREMIUM QUALITY uPVC EXTRUDED TUBE

SOLID CORE OF PRESSURE INJECTED EPOXY ENCAPSULANT

uPVC MOULDED HOUSING INCORPORATING 2 SENSOR POINTS OF AVESTA 254 SMO HIGH GRADE STAINLESS ALLOY

TEMPERATURE RANGE –
10 TO 80 Deg.C
14 TO 176 Deg.F

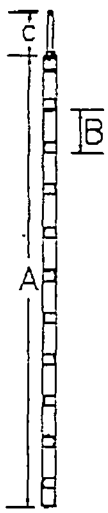
HI SPEC probes manufactured from GE NORYL and HASTALLOY C-22 are for temperatures up to 140 Deg.C, 284 Deg.F.

ACCESSORIES

Installation kit of hook, wiper/bracket screws, plugs and cable ties supplied with all probes except model 0.2/1. All metal parts are stainless.

Multi Trode products are protected by a 2 YEAR WARRANTY.

Multi Trode products are covered by International patents, including AU 588259, EUR 85905496.7, JAP 504912/1985, NZ 213999 and US 4739786



DIMENSIONS

MODEL	A	B	C
2.5/10-10m	2.5	250	10m
2.5/10-30m	2.5	250	30m
2.0/10-10m	2.0	200	10m
2.0/10-30m	2.0	200	30m
1.5/10-10m	1.5	150	10m
1.5/10-30m	1.5	150	30m
1.0/10-10m	1.0	100	10m
1.0/10-30m	1.0	100	30m
0.5/3-10m	0.5	150	10m
0.5/3-30m	0.5	150	30m
0.2/1-10m	0.2	–	10m
0.2/1-30m	0.2	–	30m

A – NOMINAL LENGTH (m)
B – SENSOR DIFFERENTIAL (mm)
C – CABLE LENGTH (m)

SENSOR NUMBERING

#1-10 TOP TO BOTTOM

Multi Trode probes are suitable for use in a wide range of corrosive liquids.

ORDERING INFORMATION

MULTI TRODE-□□/□□-□□

- PROBE LENGTH IN METRES: 0.2, 0.5, 1.0, 1.5, 2.0, 2.5
- No. OF SENSORS: 10, 3, 1
- CABLE LENGTH: 10 OR 30 METRES

MULTITRODE DESIGNED AND MANUFACTURED BY SARTEK

BEP

New South Wales Office
Unit 12 & 13, Centre West
108 Silverwater Road
Silverwater NSW 2141
Tel: (02) 647 3700
Fax: (02) 748 3021

Victoria Office
9-10 Bastow Place
Mulgrave Vic 3170
Tel: (03) 561 7000
Fax: (03) 562 1322

South Queensland Office
123 Boundary Street
West End Qld 4101
Tel: (07) 844 1711
Fax: (07) 844 8878

South Australia Office
1027 Port Road
Alberton SA 5014
Tel: (08) 47 2622
Fax: (08) 341 1360

West Australia
20 Hines Road
O'Connor WA 6163
Tel: (09) 337 4411
Fax: (09) 331 2774

Tasmania Office
412 Brooker Highway
Derwent Park Tas 7009
Tel: (002) 72 4744
Fax: (002) 72 8599

North Queensland Road
46 Ingham Road
Townsville Qld 4810
Tel: (077) 72 2599
Fax: (077) 72 3925

SECTION Y

SECTION Z

KENNEDY TAYLOR (QLD) AS CONSTRUCTED DRAWINGS

PLACE OF INSTALLATION		INDOOR
TYPE OF INSTALLATION		STATIONARY
S.C.A.DESIGN	DESIGN	CONSTRUCTED FROM 2mmTHK.Z/S SHEET STEEL.FLOOR MOUNTED. ARRANGED FOR FRONT ACCESS. INCOMING CONNECTIONS-BOTTOM ENTRY SUBMAINS- BOTTOM ENTRY
SEGREGATION CLASIFICATION		FORM 3 TO AS1136.1
ELECTRICAL DATA.	SUPPLY	415V A.C. 3PHASE AND NEUTRAL
	CONTROL VOLTAGE	110VAC
	PLC CONTROL VOLTAGE	110VAC
	INSULATION RATING	0.6/1KV
	RATED SHORT TIME WITHSTAND CURRENT	35 KA FOR 1 SECOND
	FREQUENCY	50HZ
DEGREE OF PROTECTION		IP54 TO AS1939
EARTHING SYSTEM		MEN
PLINTH	MATERIAL	75x40x THICK WELDED CHANNEL STEEL
	LIFTING METHOD	VIA 4x50mm HOLES IN BASE CHANNELS
	FIXINGS	VIA 12mm DIA HOLES IN LOWER FLANGE
	FINISH	HOT DIP GALVANISED
CABLES	POWER	V75 0.6/1KV (IN PHASE COLOURS) STRANDED MIN 2.5mm2
	CONTROL	V75 0.6/1KV MIN 1.5mm2
	PLC	V75 240V MIN 1mm2 TO MARSH.TERMS.
	COLOURS:-	NEUTRAL - BLACK 240VAC ACTIVE-RED GENERAL CONTROL-240VAC RED GENERAL CONTROL-110VAC GREY GENERAL CONTROL-ELV ORANGE ANALOGUE-SHIELDED PAIR 0.5mm2
	IDENTIFICATION	USE GRAVOPLAST MARKERS. PREFIX WIRES THAT LEAVE DRIVE MODULE e.g.PP1/ NOTE * MARKERS BELOW
TERMINATION	CONTROL	"SPARK" TYPE GRAVOPLAST PINS INTO TERMINALS
	MAINS INCOMING	1x240mm2 PER PHASE 1x240mm2 NEUTRAL
	POWER CABLES OUTGOING LOADS	PUMPS 1x240mm2 PER PHASE DIRECT ONTO CONTACTOR CONNECTIONS

BUSBARS	FINISH	NATURAL
	JOINTS	KT STANDARD LOCKING CHANNELS/TABS NON STANDARD USE LOCKNUTS WHEN CHANNELS AND TABS CANNOT BE USED
	APPLY JELLY TO JOINT PRIOR TO JOINTING	ALL JOINTS TO BE MARKED WHEN TIGHTENED
	COATING	PAINT PHASE BUSBARS BLACK
	PHASE IDENTIFICATION	COLOUR CODED PAINTED BANDS 50mm WIDE EVERY 300mm RED.WHITE.BLUE.
	NEUTRAL	BLACK PAINTED BANDS EVERY 300mm
	EARTH	GREEN/YELLOW PAINTED BANDS EVERY 300mm
	M.E.N. LINK	GREEN/YELLOW AND BLACK PAINTED BANDS
MAIN BUS BARS	PHASE BARS-SIZE	INC.SECTION-REFER DWG.
	PHASE BARS-SIZE	MCC MAIN BUS-3x160x6.3 PER PHASE
	NEUTRAL BAR-SIZE	MCC MAIN BUS-1x160x6.3
EARTH BAR	SIZE	1x32x6.3 CU PROVIDE PROVISION FOR ALL CIRCUITS +20% SPARE
GLAND PLATES	INC-BOTTOM OF BD.	6mmTHK ALUM WITH GASKET-EARTHED
	STARTERS-BOTTOM OF BD.	6mmTHK ALUM WITH GASKET-EARTHED
PAINTING	STANDARD	TO K-T STANDARD PAINT SPECIFICATION
	EXTERNAL COLOUR	ELECTRIC ORANGE
	INTERNAL COLOUR	ELECTRIC ORANGE EQUIP. PANELS-WHITE
LABELS:- EXTERNAL AND INTERNAL	GENERAL LABELS	WHITE BACKGROUND WITH BLACK LETTERS
	WARNING LABELS	RED BACKGROUND WITH WHITE LETTERS
	DANGER LABELS	RED BACKGROUND WITH WHITE LETTERS
	FIXING EXTERNAL	VIA M3 STAINLESS STEEL SCREWS
	FIXING INTERNAL	VIA M3 STAINLESS STEEL SCREWS
	LETTER HEIGHT	MINIMUM HEIGHT TO BE 3mm
	CIRCUIT I.D.LABELS	TO BE 10mm HIGH
	MAIN SCA LABEL	TO BE 20mm HIGH

DUSTPROOF DETAILS	DOORS	NEOPRENE RUBBER 25X5mm
	COVERS	NEOPRENE RUBBER 25x5mm
DOOR FIXING DETAILS		"T" HANDLES
COVER FIXING DETAILS		ACORN HEAD BOLTS WITH 2 LOCATING PINS PER COVER

CUBICLE CONSTRUCTION DETAILS

CUBICLE MATERIAL- 2mm THICK ZINC ANNEALED MILD STEEL SHEET
PLINTH- 75x40x6mm THICK WELDED CHANNEL
EQUIP. PANELS- 2.5mm THICK ZINC ANNEALED MILD STEEL SHEET

GENERAL- ENCLOSURE TO BE FULLY WELDED SELF SUPPORTING FREE FROM DENTS,SURFACE DEFECTS,DRUMMING ETC. WELDS TO BE FULL FILLET GROUND SMOOTH.

DOORS TO HAVE A MINIMUM RETURN OF 15mm AND BE CAPABLE OF OPENING 100 DEGREES. STIFFENED AS REQUIRED AND FITTED WITH CHROME "T" HANDLES(L AND F 92268)

ALL DOORS TO BE PROVIDED WITH TWO STUDS,ONE ON DOOR AND ONE ON CABINET WITH A 4mm EARTH CABLE BETWEEN.

DOORS OVER 400mm HIGH TO HAVE TWO HANDLES,WHILE THOSE OVER 1000mm HIGH SHALL HAVE THREE.

HANDLES ON DOORS WHICH ARE INTERLOCKED WITH SUPPLY OR ON DOORS WHICH COVER ESCUTCHEONS SHALL BE NON LOCKABLE

ALL OTHER DOORS TO BE LOCKABLE

DOORS AND ESCUTCHEONS TO HAVE MIN. 2 LIFT OFF PINTLE HINGES AND THOSE OVER 1000mm SHALL HAVE THREE HINGES.

REMOVABLE COVERS FASTENED BY FOUR CHROME PLATED ACORN HEAD BOLTS, OR BY SIX BOLTS IF OVER 1000mm IN ANY DIRECTION

GLAND PLATES FIXING HOLES 150mm APART INTO NUTSERTS, GASKETED AND EARTHED.

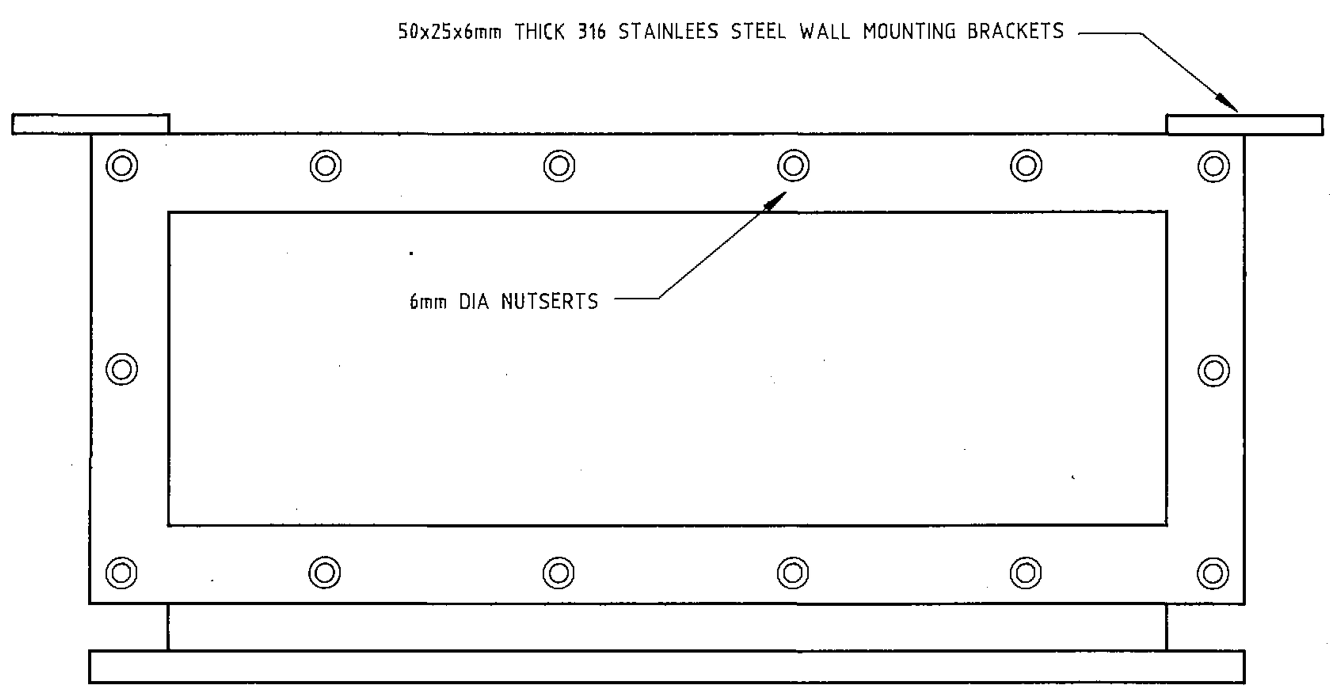
AS CONSTRUCTED

DRAWING REFERENCE	DRAWING NO	REV	DESCRIPTION	DATE	BY	ENG
MOTOR CONTROL CENTRE REAR VIEW	Q3B02-B1-1					
MOTOR CONTROL CENTRE FRONT VIEW	Q3B02-B1-2					

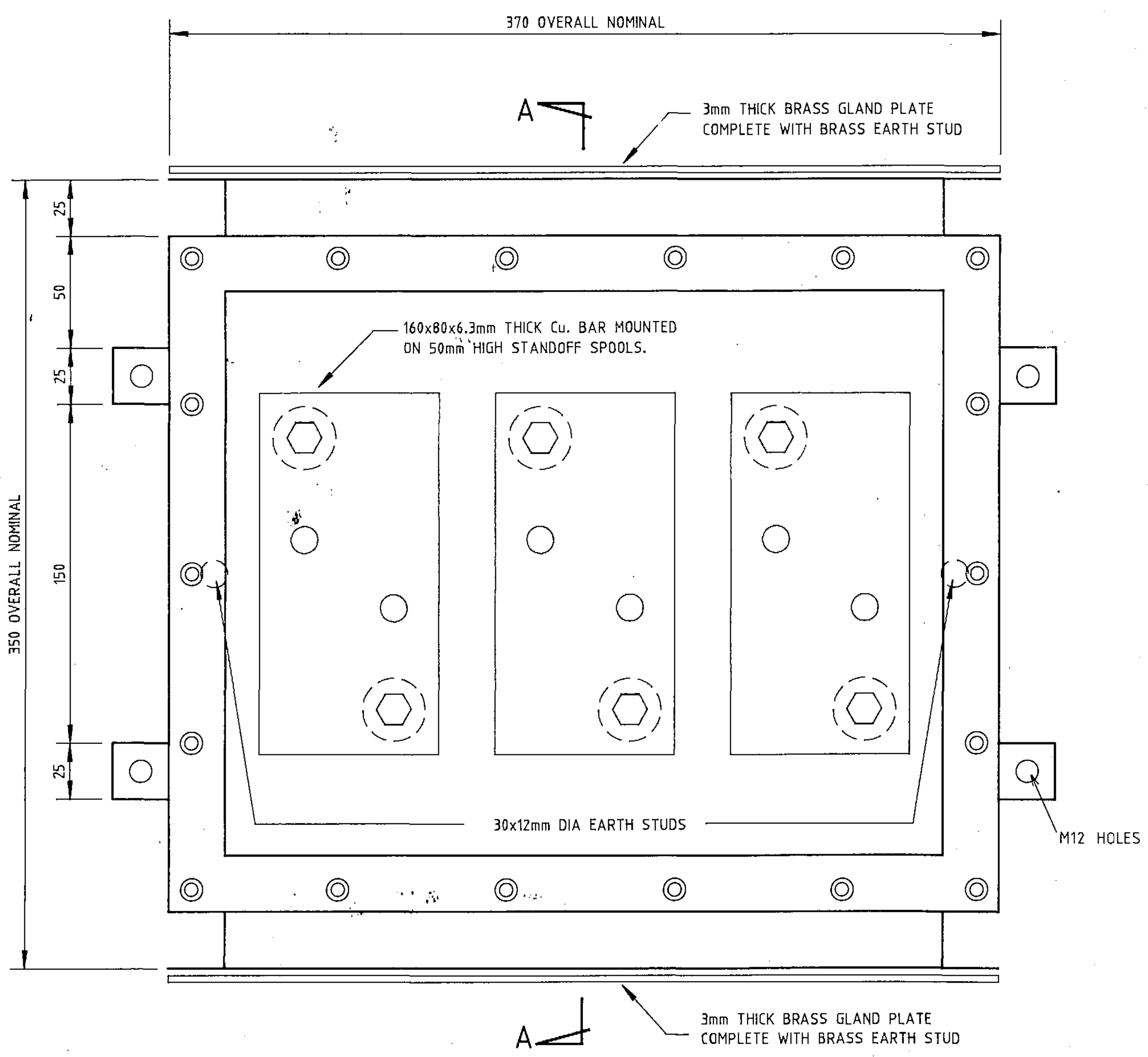
PROJECT: CASWELL STREET PUMP STATION
ITEM: GENERAL NOTES MOTOR CONTROL CENTRE
CLIENT: BRISBANE CITY COUNCIL

KENNEDY-TAYLOR (QLD) PTY. LTD. INCORPORATED IN QUEENSLAND
A MEMBER OF ECTEC LIMITED GROUP
562 CURTIN AVENUE EAST EAGLE FARM.
QUEENSLAND, AUSTRALIA.
TELEPHONE:(07)268 1082 FAX:(07)268 4121

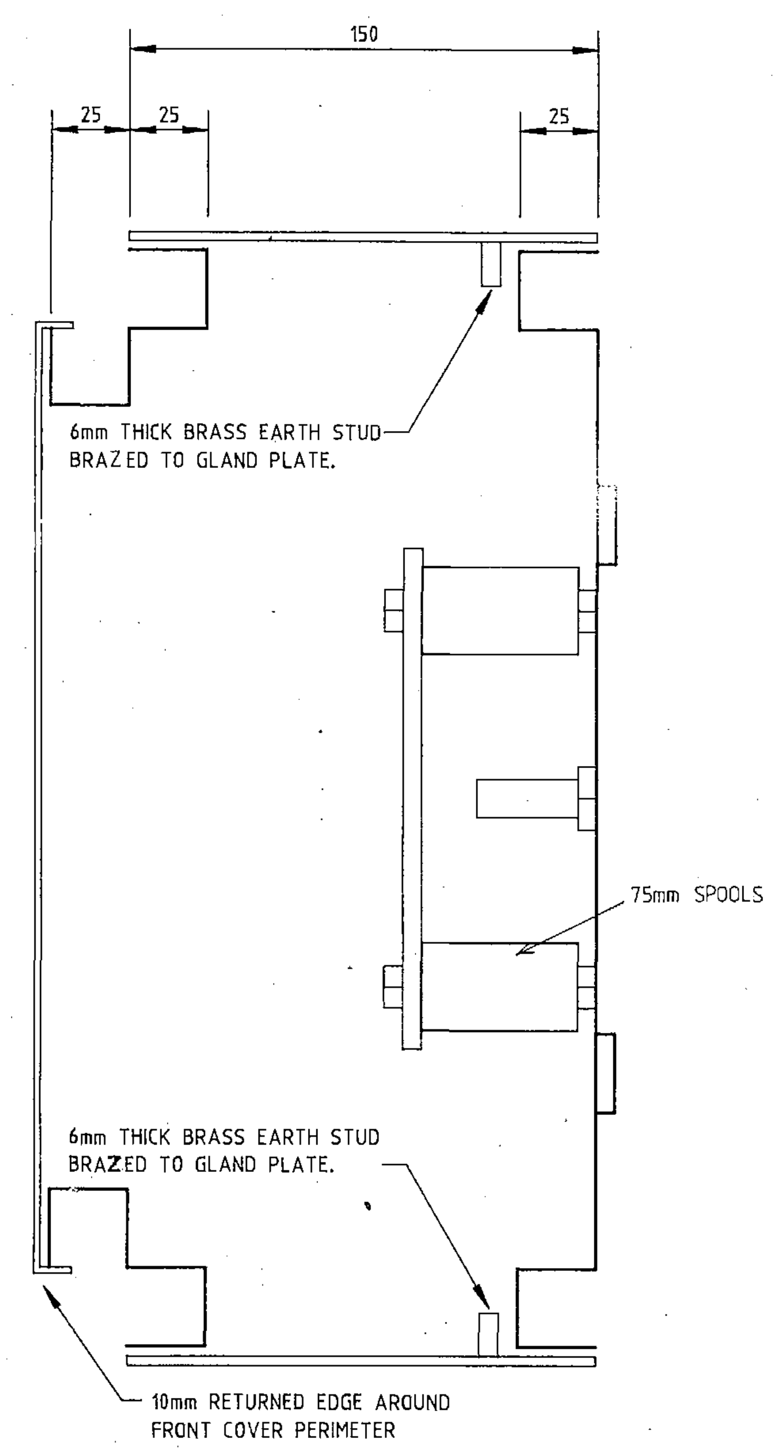
JOB No. Q3B02	
SCALE NTS	DATE 23/2/93
DRAWN PK	CHECKED MS
DRAWING No. Q3B02-A3-3	REV 0



PLAN VIEW



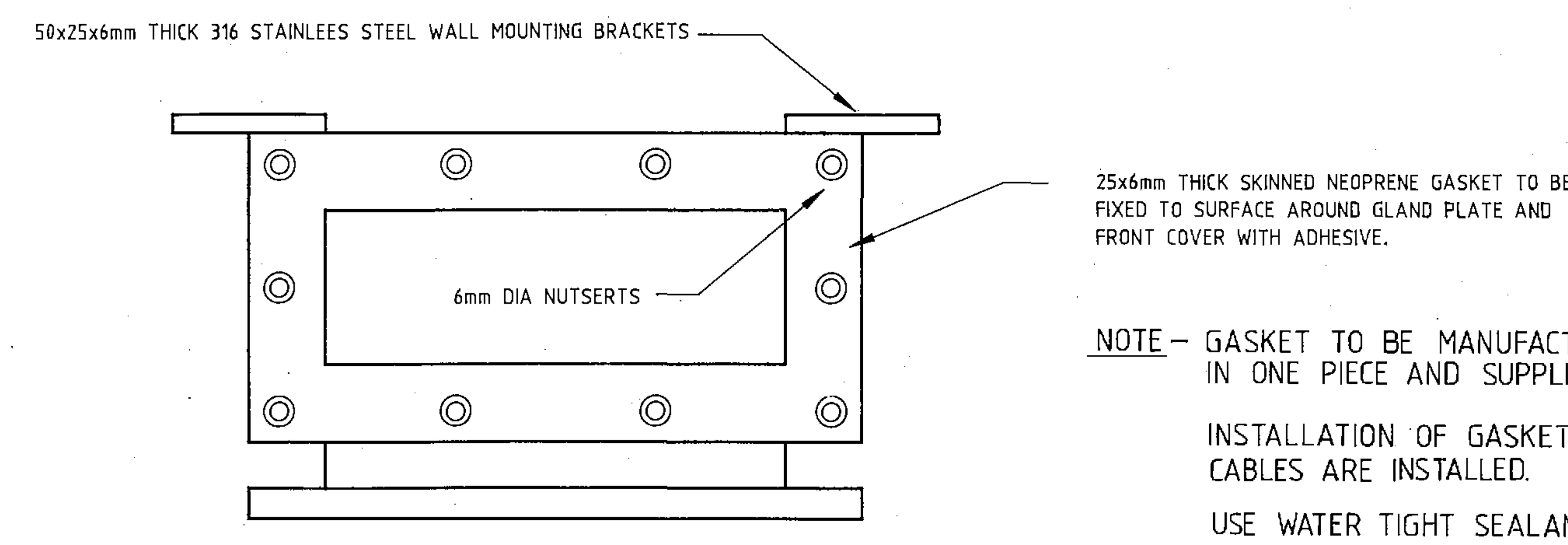
FRONT ELEVATION



SECTION 'A-A'

3 OFF POWER JUNCTION BOXES

NOTE: J BOXES TO BE MANUFACTURED FROM 316 STAINLESS STEEL (B GRADE)
BOXES TO HAVE AN INGRESS PROTECTION OF IP67 (FULLY WELDED)

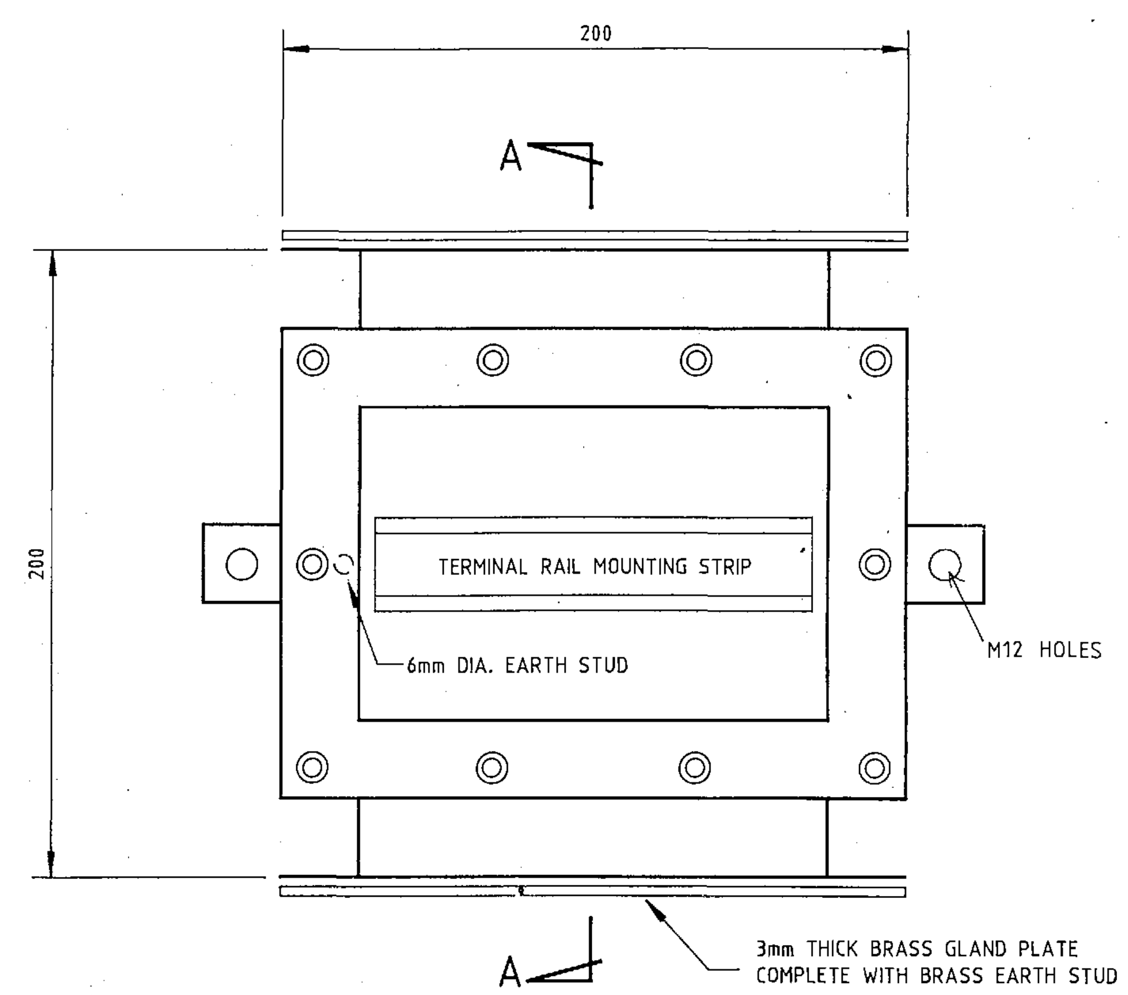


PLAN VIEW

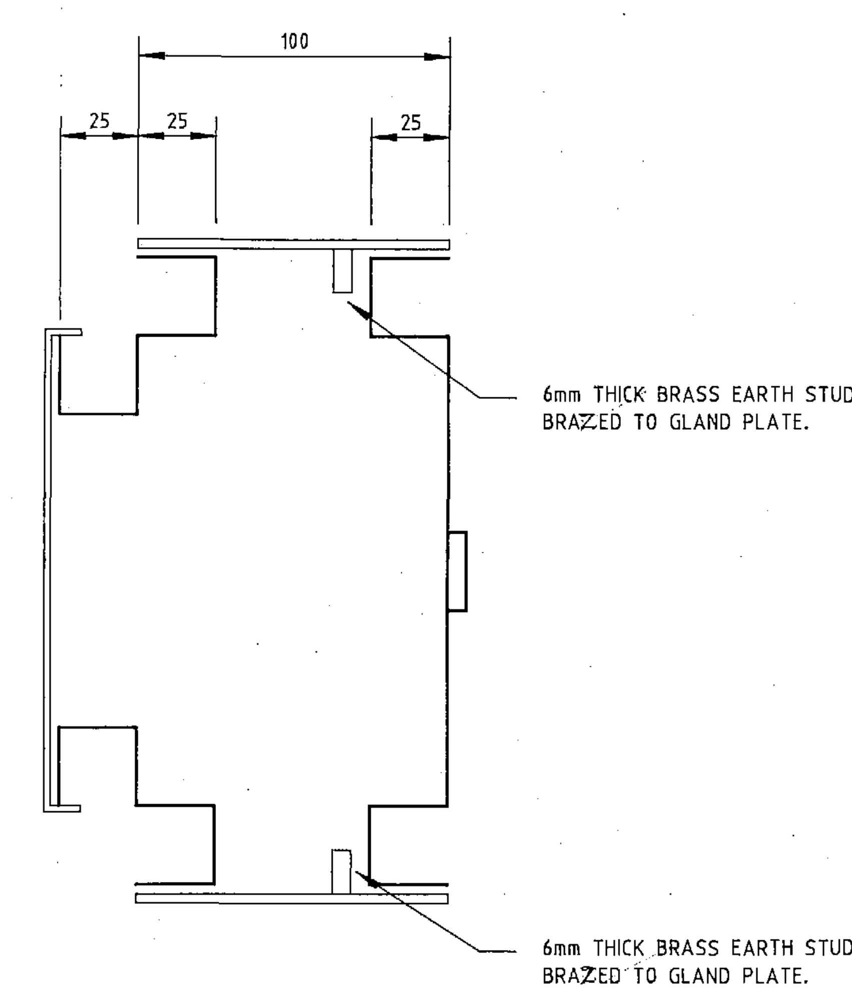
NOTE – GASKET TO BE MANUFACTURED FROM SHEET NEOPRENE IN ONE PIECE AND SUPPLIED LOOSE.

INSTALLATION OF GASKET TO BE CARRIED OUT WHEN CABLES ARE INSTALLED.

USE WATER TIGHT SEALANT ON BOTH SURFACES OF GASKET.



FRONT ELEVATION



SECTION 'A-A'

3 OFF CONTROL JUNCTION BOXES

NOTE: J BOXES TO BE MANUFACTURED FROM 316 STAINLESS STEEL (B GRADE)
BOXES TO HAVE AN INGRESS PROTECTION OF IP67 (FULLY WELDED)

AS CONSTRUCTED

PROJECT

CASWELL STREET PUMPING STATION JUNCTION BOX DETAILS

REVISIONS

REV	DESCRIPTION	BY	CHKD.	APP'VD	DATE
2	AS CONSTRUCTED	PK	MS	MS	5-10-93
1	ISSUED FOR APPROVAL	P.A.S.	MS	MS	25-3-93

APPROVAL	DRAWING No.	TITLE

REFERENCE DRAWINGS

KENNEDY-TAYLOR (QLD) PTY LTD
ELECTRICAL ENGINEERS & CONTRACTORS PHONE (07) 268 1082 BRISBANE

DRAWN BY	P. SMITH	25-3-93
DESIGNED	M. SMYTH	25-3-93
APPROVED		
SCALE	1 : 2.	
CLIENT	BRISBANE CITY COUNCIL	

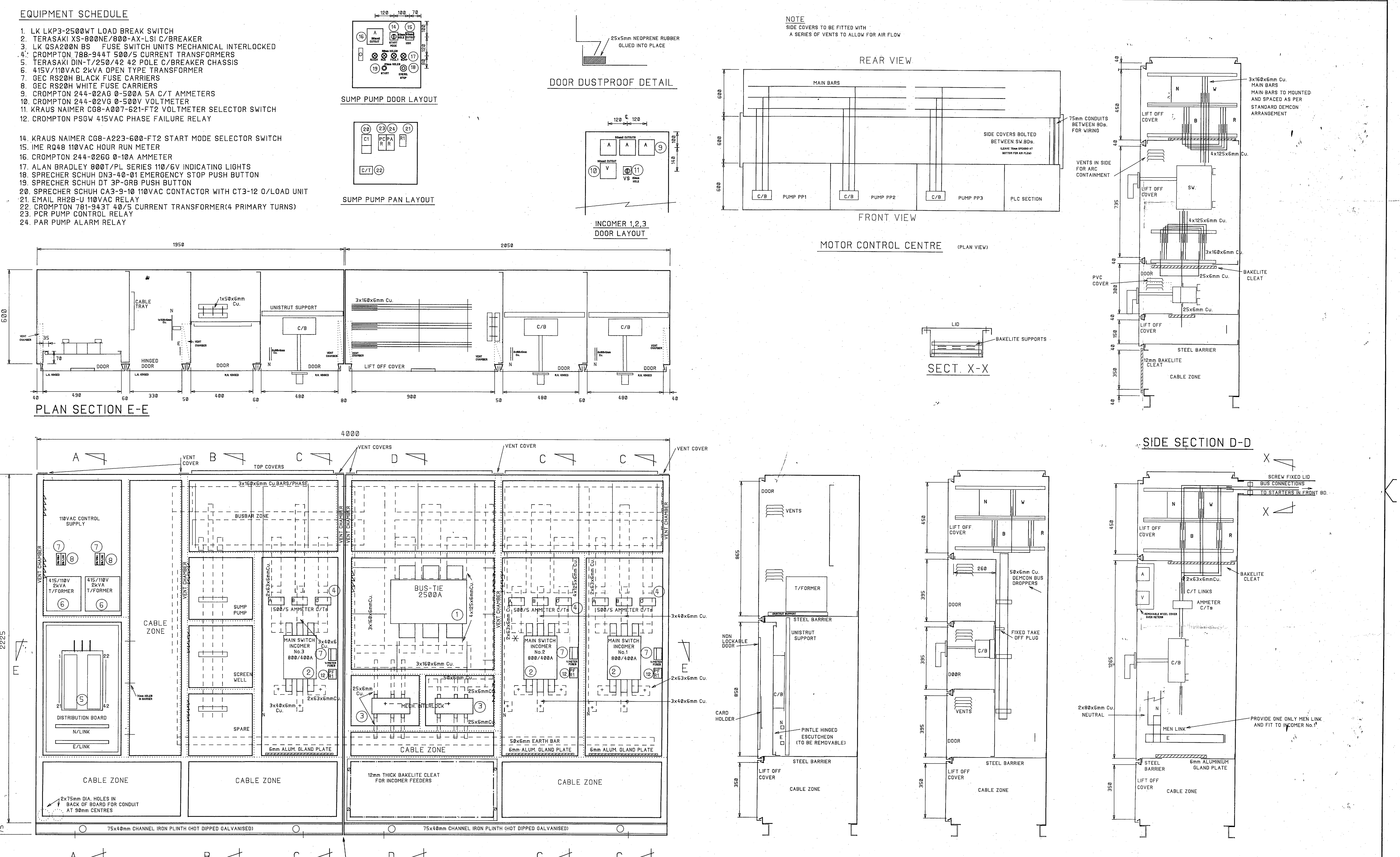
CASWELL STREET JUNCTION BOXES
FRONT ELEVATION, NOTES, DETAILS AND SECTION

JOB No.	DRAWING No.	REV.
Q3B02	Q3B02-A1-04	2

EQUIPMENT SCHEDULE

1. LK LKP3-2500WT LOAD BREAK SWITCH
2. TERASAKI XS-800NE/800-AX-LSI C/BREAKER
3. LK QSA200N BS FUSE SWITCH UNITS MECHANICAL INTERLOCKED
4. CROMPTON 788-944T 500/5 CURRENT TRANSFORMERS
5. TERASAKI DIN-T/250/42 42 POLE C/BREAKER CHASSIS
6. 415V/110VAC 2kVA OPEN TYPE TRANSFORMER
7. GEC RS20H BLACK FUSE CARRIERS
8. GEC RS20H WHITE FUSE CARRIERS
9. CROMPTON 244-02AG 0-500A 5A C/T AMMETERS
10. CROMPTON 244-02VG 0-500V VOLTMETER
11. KRAUS NAIMER CG8-A007-621-FT2 VOLTMETER SELECTOR SWITCH
12. CROMPTON PSGW 415VAC PHASE FAILURE RELAY

14. KRAUS NAIMER CG8-A223-600-FT2 START MODE SELECTOR SWITCH
15. IME RQ48 110VAC HOUR RUN METER
16. CROMPTON 244-026G 0-10A AMMETER
17. ALAN BRADLEY 800T/PL SERIES 110/6V INDICATING LIGHTS
18. SPRECHER SCHUH DN3-40-01 EMERGENCY STOP PUSH BUTTON
19. SPRECHER SCHUH DT 3P-GRB PUSH BUTTON
20. SPRECHER SCHUH CA3-9-10 110VAC CONTACTOR WITH CT3-12 O/LOAD UNIT
21. EMAIL RH2B-U 110VAC RELAY
22. CROMPTON 781-943T 40/5 CURRENT TRANSFORMER(4 PRIMARY TURNS)
23. PCR PUMP CONTROL RELAY
24. PAR PUMP ALARM RELAY



REAR VIEW (DOORS/COVERS REMOVED)

✱ ALLOW MOUNTING FACILITIES AND BUSBAR CONNECTIONS TO SUIT 125mm BARS FOR FUTURE 2500A C/BREAKER

TRANSPORT SPLIT

AS CONSTRUCTED

REFERENCE DRAWINGS	DRAWING NO.
MOTOR CONTROL CENTRE FRONT VIEW	Q3B02-B1-2
MOTOR CONTROL CENTRE GENERAL NOTES	Q3B02-A3-3

REV.	DATE	DESCRIPTION	DRN.	CKD.
2	5/10/93	AS CONSTRUCTED	PK	MS
1	2/3/93	B.C.C. REVISIONS ADDED	PK	MS

THIS DRAWING AND ALL PRINTS THEREOF ARE THE PROPERTY OF KENNEDY-TAYLOR(QLD)PTY.LTD. AND MUST NOT BE LOANED,COPIED IN ANY PART OR OTHERWISE COMMUNICATED TO A THIRD PARTY WITHOUT WRITTEN PERMISSION AND ARE RETURNABLE UPON DEMAND

ISSUE

PROJECT: CASWELL STREET PUMP STATION
ITEM: MOTOR CONTROL CENTRE REAR VIEW
CLIENT: BRISBANE CITY COUNCIL

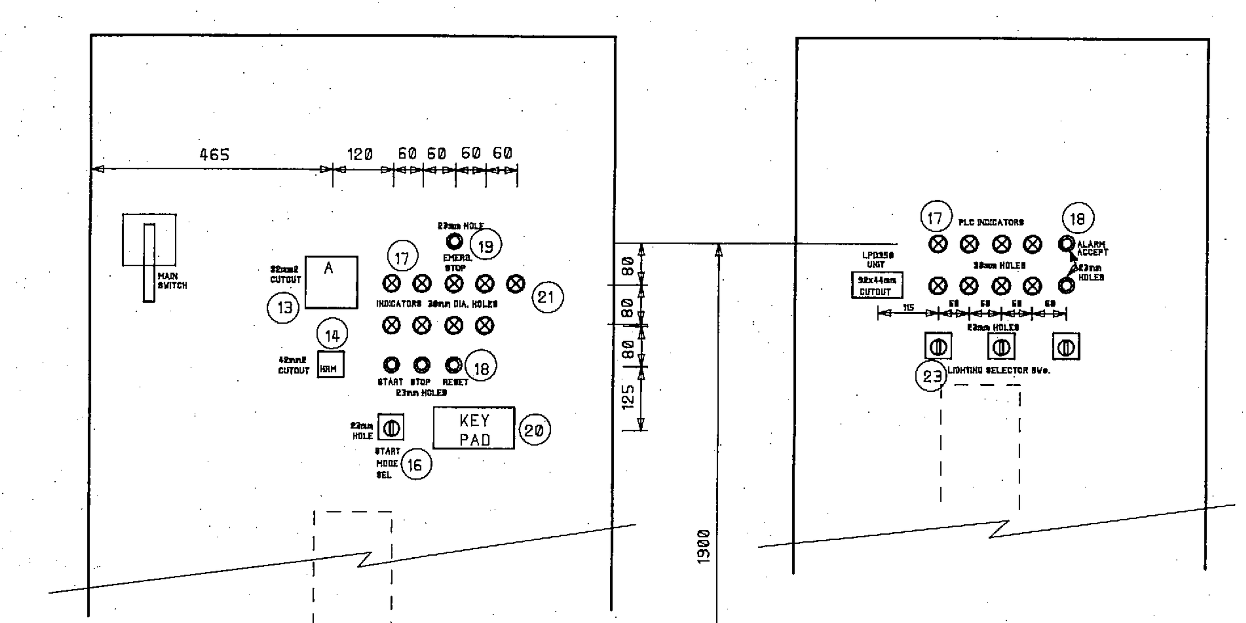
KENNEDY-TAYLOR (QLD) PTY. LTD.
A MEMBER OF ECTEC LIMITED GROUP
562 CURTIN AVENUE EAST EAGLE FARM
QUEENSLAND AUSTRALIA
TELEPHONE:(07)268 1082. FAX:(07)268 4121

JOB No.	Q3B02
SCALE	1:10
DATE	18/2/93
DRAWN	PK
CHECKED	MS
DRAWING No.	Q3B02-B1-1
REV	2

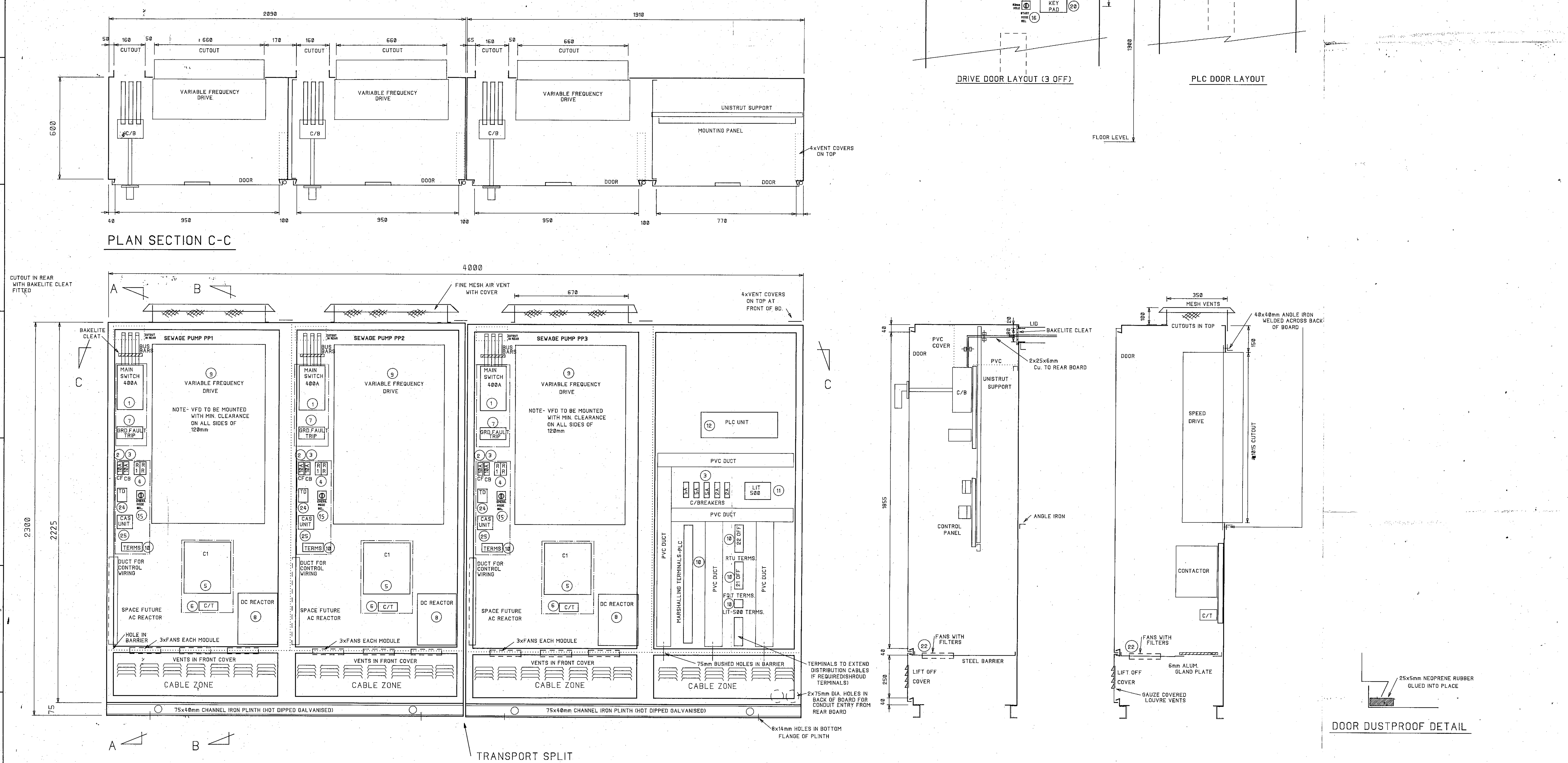
EQUIPMENT SCHEDULE

1. TERASAKI XS-400CJ/400-AX C/BREAKER
2. GEC RS20H BLACK FUSE CARRIERS
3. TERASAKI DIN-T6 SERIES C/BREAKERS
4. EMAIL RH2B-U 110VAC RELAYS
5. SPRECHER SCHUH CA1-400 110VAC CONTACTOR
6. CROMPTON 789-944T 400/5 CURRENT TRANSFORMER
7. FUJI MCAII-GFD-2 FAULT TRIP UNIT
8. FUJI DC REACTOR
9. FUJI FRN 200 P7-4 210KW VARIABLE FREQUENCY DRIVE
10. KLIPPON SAK4 TERMINALS
11. LIT-500 LEVEL DISPLAY TRANSMITTER
12. GE FANYC SERIES 90-30 PLC UNIT
13. CROMPTON 244-026G 0-400A AMMETER
14. IME RQ48 110VAC HOUR RUN METER
15. KRAUS/NAIMER CG8-A221-600-FT2 START MODE SEL. SWITCH
16. KRAUS/NAIMER CG8-A369-600-FT2 EMERG. MODE SEL.SWITCH
17. ALAN BRADLEY 800T/PL SERIES 110/6V INDICATING LIGHTS
18. SPRECHER SCHUH DT 3P-GRB PUSH BUTTONS
19. SPRECHER SCHUH DN3-40-01 EMERGENCY STOP PUSH BUTTON
20. FUJI KEYPAD DISPLAY FOR VARIABLE SPEED DRIVE
21. ALAN BRADLEY 800T/PL SERIES 24V INDICATING LIGHTS
22. RS COMPONENT VENTILATION FAN 240VAC CAT.No.508-071
23. KRAUS NAIMER CG8-A200-621-FT2 LIGHTING SELECTOR SWITCHES
24. CROMPTON KW TRANSDUCER
25. CAS UNIT

NOTE-- ALL DOOR MOUNTED EQUIPMENT TO BE SHROUDED


DRIVE DOOR LAYOUT (3 OFF)

PLC DOOR LAYOUT


PLAN SECTION C-C

FRONT VIEW (DOORS/COVERS REMOVED)

SIDE SECTION A-A

SIDE SECTION B-B

DOOR DUSTPROOF DETAIL

CAD FILE- Q3802-2

AS CONSTRUCTED

REFERENCE DRAWINGS	DRAWING NO.
MOTOR CONTROL CENTRE REAR VIEW	Q3802-B1-1
MOTOR CONTROL CENTRE GENERAL NOTES	Q3802-A3-3

REV.	DATE	DESCRIPTION	DRN.	CKD.
2	5-10-93	AS CONSTRUCTED	PK	MS
1	2/3/93	B.C.C. REVISIONS ADDED	PK	MS

THIS DRAWING AND ALL PRINTS THEREOF ARE THE PROPERTY OF KENNEDY-TAYLOR(QLD)PTY.LTD. AND MUST NOT BE LOANED,COPIED IN ANY PART OR OTHERWISE COMMUNICATED TO A THIRD PARTY WITHOUT WRITTEN PERMISSION AND ARE RETURNABLE UPON DEMAND

PROJECT: CASWELL STREET PUMP STATION

ITEM: MOTOR CONTROL CENTRE FRONT VIEW

CLIENT: BRISBANE CITY COUNCIL

KENNEDY-TAYLOR (QLD) PTY. LTD.
A MEMBER OF ECTEC LIMITED GROUP
562 CURTIN AVENUE EAST EAGLE FARM
QUEENSLAND AUSTRALIA
TELEPHONE:(07)268 1082. FAX:(07)268 4121

JOB No.	Q3802
SCALE	1:10
DATE	22/2/93
DRAWN	PK
CHECKED	MS
DRAWING No.	Q3802-B1-2
REV	2