Centro Italiano Ricerche Aerospaziali

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TITLE

Adeguamento Tecnologico Azionamento del FAN della Galleria CIRA PT-1: Specifica Tecnica (Inverter+ Controllo+Motore)

PREPARED PREPARATO	REVISED VERIFICATO	APPROVED APPROVATO	AUTHORIZED AUTORIZZATO
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DATE/DATA **05/07/2016**	DATE/DATA **05/07/2016**	DATE/DATA **05/07/2016**	DATE/DATA **05/07/2016**

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* *PT = PARTIAL*
A = ALL

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1. RIFERIMENTI GENERALI

1.1. SCOPO

Il documento descrive i requisiti per la sostituzione del sistema di azionamento (nel seguito identificato anche con “azionamento”,“variatore di velocità” o “inverter”, come sinonimi) del motore elettrico del fan dell’impianto PT-1; e’ parte integrante della fornitura una attività di revisione del motore finalizzata alla verifica del suo corretto funzionamento.

1.2. INTRODUZIONE

Il PT-1 è una galleria del vento transonica operativa dalla fine degli anni ’90. Il flusso nel circuito della galleria è alimentato da aria compressa, proveniente da una centrale esterna, oppure da un’elica mossa, a velocità variabile, da un motore elettrico a corredo dell’impianto.

I parametri funzionali e le logiche di gestione della galleria sono controllate da un sistema di automazione centralizzato.

La galleria è operativa sulla base di programmi di prova prestabiliti.

1.3. DOCUMENTI APPLICABILI

AD[1]: CIRA-CF-07-0780 rev.0 “Condizioni Generali per i Contratti di Fornitura CIRA”
AD[2]: CIRA-CF-09-1064 rev 0 “Procedura per l'accettazione di personale esterno e norme di comportamento”

2. SISTEMA OGGETTO D’INTERVENTO

2.1. DESCRIZIONE

Il sistema oggetto d’intervento è il sistema di azionamento che alimenta elettricamente il motore dell’elica (FAN). Cuore del sistema è un Inverter marca Jeumont Schneider mod. Invertron 3-VCI-S-305, vedi immagine seguente, ed è fuori servizio da tempo.

Figura 1: Inverter esistente

Le apparecchiature sono alloggiate in un quadro elettrico, il cui schema è in allegato, installato nel capannone della galleria, come da seguente layout:

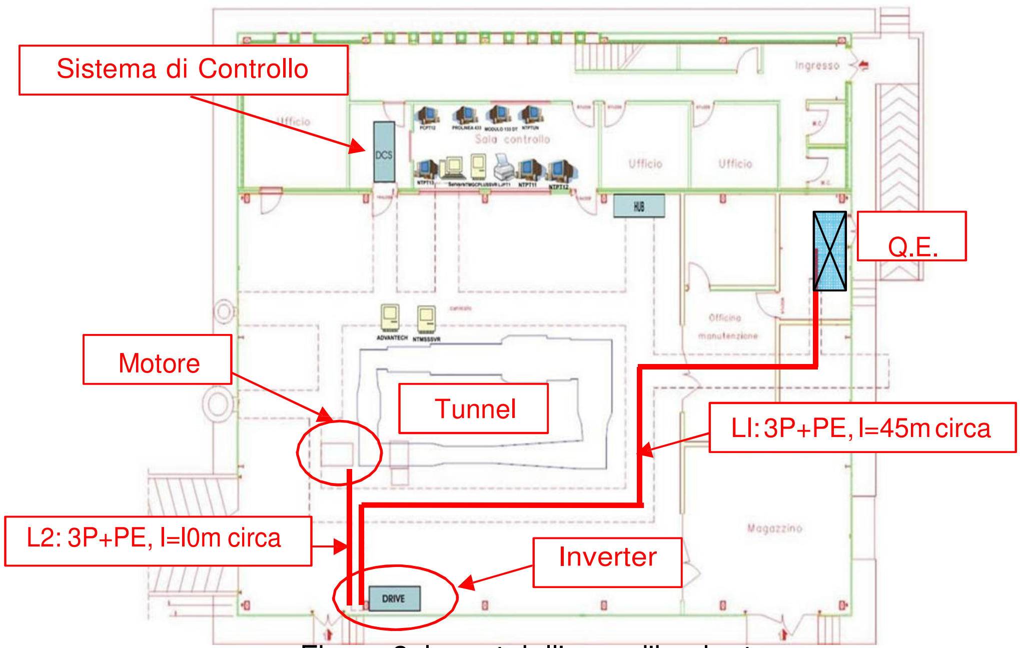


Figura 2: layout dell'area d'impianto

Il motore elettrico pilotato dall'azionamento è un motore asincrono trifase, marca Leroy Somer mod. F315 L2 B3, raffigurato nella seguente immagine:

Figura 3: motore elettrico esistente

Il motore elettrico è fermo da tempo, a causa del guasto all'inverter, ma non si ricorda essere stato lasciato non funzionante o con anomalie presenti.

L'encoder del motore è un Hohner PB 05/5/9/06R/1024, a due serie di impulsi sfasate di 90° con uscita complementare e una traccia "zero". Numero di impulsi per giro=1024.

Il sensore vibrazioni motore è uno Schenck Vibracontrol 1100.C01 (layout allegato).

Il sistema di azionamento colloquia col sistema di automazione d'impianto tramite una serie di segnali analogici e digitali, rappresentati nel seguente schema:

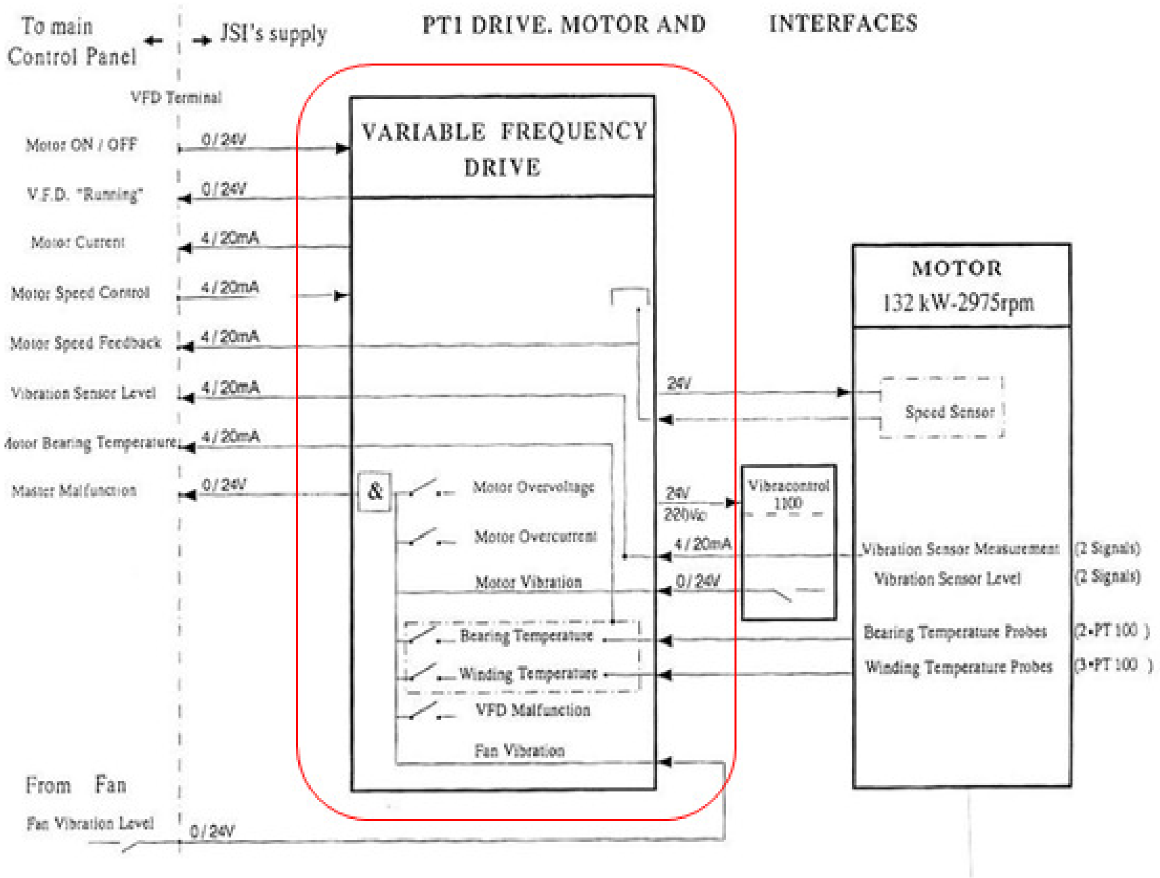
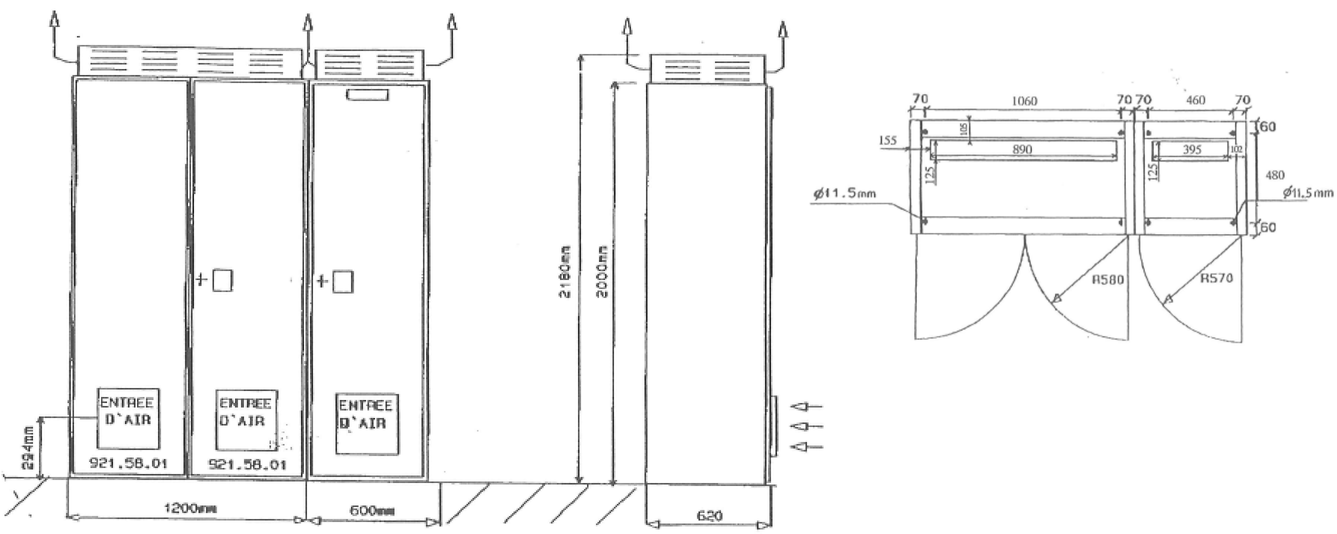


Figura 4: segnali dell'azionamento

Il nuovo Sistema dovrà essere installato nella stessa posizione di quello attuale. In allegato le dimensioni esterne degli attuali quadri le cui dimensioni sono da considerare come riferimento:



2.2. SPECIFICHE TECNICHE DELL’ATTUALE SISTEMA

Dalla documentazione tecnica di progetto e fornitura delle apparecchiature attualmente installate, si evincono le seguenti caratteristiche tecniche principali ad esse relative:

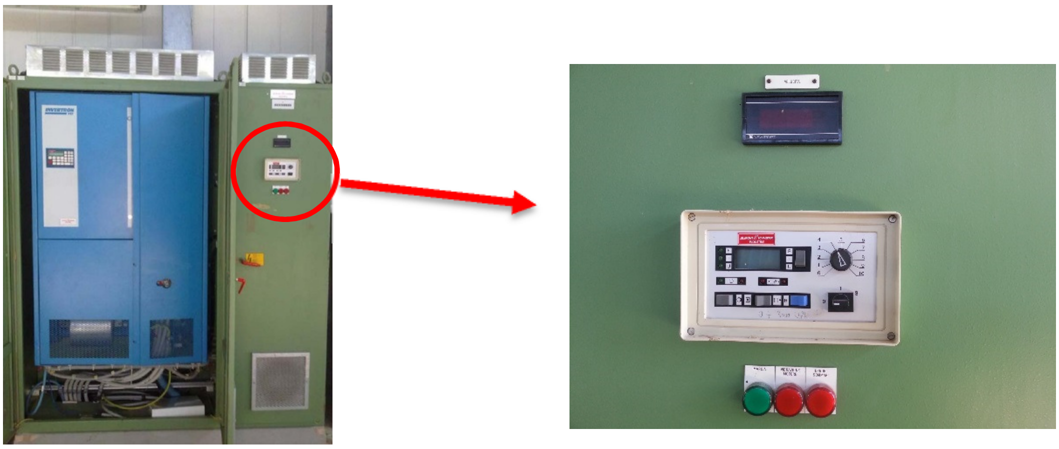
2.2.1 Inverter

Alimentazione	3P, 400V±10%, 48÷62Hz
Frequenza d’uscita	0,5÷240Hz
Precisione frequenza d’uscita	0,1%
Campo di variazione velocità	295÷2955rpm
Massima corrente d’uscita	305A
Fattore di potenza	>0,95
Efficienza	>96%

2.2.2 Motore

Potenza nominale	145kW
Velocità	2950 rpm
Alimentazione	3P, 400V, 50Hz
Corrente nominale	275A
Coppia nominale	468mN
Coupling	Δ
Efficienza	>93%
Fattore di potenza	0,87
Classe d’isolamento	F

L’azionamento, oltre ad essere collegato al sistema di controllo della galleria e quindi oltre ad essere comandato da remoto, è dotato di un pannello locale tramite cui comandare il motore e/o leggere i parametri di funzionamento, gli allarmi, lo stato dell’azionamento.



Lo schema elettrico del quadro, e la documentazione delle apparecchiature sono allegate.

3. OGGETTO DI FORNITURA

Oggetto della fornitura è la sostituzione del sistema di azionamento esistente (i.e. Schneider mod. Invertron 3-VCI-S-305) con uno di nuova generazione e di una opportuna interfaccia HW/SW che si integri perfettamente col resto dell'impianto e consenta il raggiungimento delle prestazioni attese dal motore del fan, ovvero il suo regolare funzionamento. I parametri di riferimento sono quelli riportati al precedente par. 2.2, ed in particolare al par. 2.2.1.

Lo scopo di fornitura prevede le seguenti cinque macro attività:

- Progettazione esecutiva del nuovo azionamento;
- Smontaggio delle apparecchiature da sostituire;
- Fornitura e posa in opera del nuovo azionamento;
- Revisione del motore e dei sensori su di esso installati (i.e. termocoppie, encoder numero di giri, sensore di vibrazione); verifica funzionamento Motore;
- Collaudo finale.

La consegna al Committente del sistema pronto a funzionare e collaudato è fissato entro 3 mesi dall'accettazione dell'ordine da parte del Fornitore.

3.1. SCOPO E REQUISITI DI FORNITURA

3.1.1. <u>Materiali</u>

E' richiesta la fornitura dei seguenti materiali ed apparecchiature:

- nr. 1 azionamento per l'esistente motore elettrico asincrono trifase in grado di variarne la velocità di rotazione in base ai requisiti di cui al par. 2.2, e che tenga conto delle seguenti condizioni:

Impostazione di rampe di accelerazione/decelerazione (funzione freno)	Regolabili da 0,01s a 10s (min), lineare, a “S” a “U” o personalizzata;
Temperatura ambiente di funzionamento	-10°C a +40 °C;
Umidità relativa massima	95%;
Capacità di sovraccarico	> 120% della corrente nominale (1 min);
Protezioni richieste	Massima temperatura cuscinetti motore, massima temperatura avvolgimenti motore, sovraccarico motore, sovracorrente, sovratensione, minima tensione, corto circuito tra fasi, corto circuito tra fase e terra, mancanza fase in ingresso, mancanza fase in uscita, corrente di dispersione fase-terra lato motore, sovratemperatura interna inverter.

- nr. 1 quadro elettrico per l'alloggiamento dell'azionamento e delle interfacce per lo scambio dei segnali di I/O preesistenti. Il progetto e lo schema elettrico del nuovo quadro garantirà le interfacce e le funzionalità previste dal progetto attualmente installato. Le interfacce dovranno garantire il collegamento fisico ai cavi di segnale e potenza preesistenti.

Per il dimensionamento del quadro, il Fornitore dovrà prevedere un grado di espandibilità del 20%.

Specifiche generali quadro:

- o Accesso : parte frontale
- o Entrata e uscita cavi : parte inferiore
- o Colore frontale : RAL 7035 (grigio chiaro)
- o Grado di protezione : IP23
- o Strumentazione quadro:
  - nr.1 Interruttore generale con leva comando sul frontale
  - nr.1 Gruppo di protezioni intrinseche (magnetotermiche, differenziali, fusibili)
  - nr.1 Selettore controllo locale/remoto
  - nr.1 Segnalazione ottica stato di malfunzionamento generale dell'inverter
  - nr.1 Segnalazione ottica allarme vibrazione
  - nr.1 Voltmetro tensione ingresso quadro, completo di selettore fasi
  - nr.1 Amperometro corrente ingresso quadro, completo di selettore fasi
- o Interfacce di I/O (rif. figura 4):
  - Ingressi (5 x PT100, 1 x 4-20mA, 3 x digitale, 1 x encoder):
    - i1. nr.1 Sensore di velocità (encoder) Hohner PB 05/5/9/06R/1024
    - i2. nr.2 Sonde temperature cuscinetti motore, PT100, range 0-200°C, soglia d'intervento regolabile entro il range
    - i3. nr.3 Sonde temperature avvolgimenti motore, PT100, range 0-200°C, soglia d'intervento regolabile entro il range
    - i4. nr.1 Setpoint velocità motore, 4-20mA, range 0..2955 rpm
    - i5. nr.1 ingresso da sensore Vibracontrol 1100, 4-20mA, passante in uscita (vedi fig. 4 e schema quadro allegato)
    - i6. nr.1 ingresso da sensore Vibracontrol 1100, 0/24V
    - i7. nr.1 segnale massima vibrazione fan, 0/24V
    - i8. nr.1 comando start/stop motore, 0/24V
  - Uscite (2 x digitale, 4 x 4-20mA):
    - o1. nr.1 segnale di allarme generale, 0/24V, elaborazione "OR" dei seguenti segnali:
      superamento soglia temperatura cuscinetti motore (rif. i2),
      superamento soglia temperatura avvolgimenti motore (rif. i3),
      massima vibrazione motore (rif. i6),
      massima vibrazione fan (rif. i7),
      massima corrente motore,
      massima tensione motore,
      malfunzionamento inverter.

      L'informazione sulla causa di attivazione del segnale di allarme generale deve essere chiaramente identificabile tramite display o leds posizionati sulla porta esterna
    - o2. nr.1 segnale velocità attuale motore, 4-20mA, range 0..2955 rpm (regolabile)
    - o3. nr.1 segnale livello vibrazioni motore, 4-20mA (passante da ingresso i5, vedi fig. 4 e schema quadro allegato)
    - o4. nr.2 segnali temperature cuscinetti motore, 4-20mA, range 0..200°C (regolabile)
    - o5. nr.1 segnale corrente motore, 4-20mA, range 0..300A (regolabile)
    - o6. nr.1 segnalazione azionamento in funzione, 0/24V

- Alimentazioni:
  - a1. nr.1 alimentazione 12/24Vdc per encoder,
  - a2. nr.1 alimentazione 24Vdc per Vibracontrol
  - a3. nr.3 alimentazioni 24Vdc (disponibili)
  - a4. nr.1 alimentazione 220Vac per Vibracontrol

  Va garantito l'assorbimento (A) elettrico per le alimentazioni specificate.

Il numero di canali di I/O effettivamente disponibili includerà anche canali di scorta, dimensionati considerando una riserva minima del 30% per ciascun I/O con un minimo di un canale per tipologia. Per ulteriori dettagli sui collegamenti di I/O vedi lo schema elettrico allegato del quadro.

- nr. 1 pannello di controllo locale: l'azionamento sarà dotato di un terminale di programmazione e comando locale, accessibile senza aprire l'armadio che lo contiene, per l'azionamento del motore. Il comando da locale sarà alternativo, e mutuamente esclusivo, al controllo da remoto dell'inverter, ossia dal sistema di controllo centrale della galleria. Il grado di protezione sarà non inferiore a quello del quadro che lo ospita. I messaggi sul display saranno in lingua Italiana. Il pannello prevederà almeno le seguenti funzioni:
  - comando start/stop motore
  - selettore senso di rotazione (se la funzione è implementata)
  - impostazione set point di velocità
  - comandi di accelerazione/decelerazione
  - configurazione parametri (soglie, rampe, tempi)
  - visualizzazione parametri

  I parametri visualizzati includeranno i seguenti:
  - Tensione di ingresso
  - Frequenza d'ingresso
  - Tensione di uscita
  - Frequenza di uscita
  - Potenza di uscita
  - Coppia motore
  - Velocità motore
  - Stato del variatore
  - Allarmi
  - Stato del controllo (locale/remoto)
- nr.1 linea di alimentazione trifase dal Q.E. principale della galleria al Q.E. dell'azionamento.
  La verifica della linea preesistente da utilizzare è a carico del Fornitore. E' a carico del fornitore il collegamento della linea preesistente al quadro elettrico che contiene il nuovo sistema di azionamento ed il suo sistema di controllo.
- nr.1 linea di alimentazione trifase dal Q.E. dell'azionamento al motore elettrico.
  La verifica della linea preesistente da utilizzare è a carico del Fornitore. E' a carico del fornitore il collegamento della stessa al quadro elettrico che contiene il nuovo inverter ed il sistema di controllo.
- nr.1 linea di alimentazione monofase dal quadro elettrico che contiene il nuovo azionamento al quadro elettrico di controllo del fan ad esso adiacente. E' a carico del fornitore il collegamento alla linea preesistente.

3.1.2. <u>Servizi</u>

L'oggetto di fornitura include l'espletamento delle seguenti attività:

- progettazione esecutiva dell'intervento di sostituzione del sistema di azionamento attualmente installato, che includerà:

- dimensionamento ed identificazione del nuovo inverter in grado di soddisfare i requisiti di cui al par. 2.2.
  - dimensionamento ed identificazione del quadro elettrico contenente il nuovo azionamento, inclusa la definizione e progettazione delle protezioni elettriche.
  - analisi delle interfacce preesistenti, della strumentazione accoppiata all'inverter e progettazione e realizzazione delle nuove interfacce in grado di funzionare e far funzionare correttamente l'azionamento una volta inserito nel contesto della galleria.
  - identificazione e dimensionamento di tutti gli accessori e dispositivi necessari alla corretta installazione e funzionamento in opera del quadro e dell'inverter.
- verifica delle linee di scambio dati/segnali ed alimentazioni (rif. Fig.4);
- verifica isolamento motore;
- verifica funzionamento e revisione del motore e dei sensori su di esso installati (i.e. termocoppie, encoder numero di giri, sensore di vibrazione). La revisione del motore dovrà essere eseguita secondo quanto specificato dal costruttore (vedi allegato). E' da prevedere la sostituzione delle parti normalmente soggette ad usura (i.e. cuscinetti, contatti etc.).
- rimozione delle apparecchiature preesistenti da sostituire
- installazione in sito delle nuove apparecchiature
- messa in servizio e collaudo delle nuove apparecchiature
- emissione dei rapporti di fine attività e di collaudo
- L'emissione della documentazione tecnica finale:
  - Schemi elettrici;
  - Schede tecniche;
  - Manuali d'uso e manutenzione;
  - Copie di backup dei SW (sorgente) installato a bordo macchina;
  - Istruzioni per il caricamento dei SW in caso di perdita accidentale;
  - Lista ricambi;
  - Dichiarazioni e certificazioni secondo legge.
- addestramento del personale tecnico del Committente all'utilizzo del nuovo azionamento.

4. ONERI DEL FORNITORE

Sono responsabilità ed onere del Fornitore:

- La presa visione dei luoghi prima della formulazione dell'offerta
- Le verifiche di dettaglio sulle apparecchiature e sui circuiti preesistenti
- Gli attrezzaggi e gli strumenti specifici necessari durante le fasi di lavoro in sito
- Gli strumenti d'analisi, progettazione, sviluppo e collaudo delle nuove forniture

5. COLLAUDI

Sono previste due sessioni di collaudo:

1) La prima presso la sede del Fornitore, a valle dell'assemblaggio delle apparecchiature nel quadro. Per l'azionamento è a discrezione del fornitore pilotare un carico (motore) equivalente a quello definitivo (il motore della galleria) o utilizzare il motore della galleria una volta revisionato.

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Scopo del collaudo in fabbrica è la verifica dell'implementazione delle funzionalità richieste, ed avrà due fasi:

- o Con comando dell'azionamento che simuli il controllo da remoto;
- o Con comando dell'azionamento da pannello locale.

Nel caso in cui il carico viene simulato è prevista la prova strumentale delle interfacce PT100 (trasmissione 4-20mA e intervento soglie), nonché la prova strumentale della segnalazione d'uscita relativa all'allarme generale (rif. uscita o1, par. 3.1.1) e diagnostica dell'allarme.
In ogni caso, con simulazione o presenta del motore, dovrà essere prevista la simulazione dell'output fornito dal sistema Vibracontrol.

2) La seconda sessione di collaudo avverrà in sito a valle delle installazioni e delle relative verifiche preliminari (definite dal Fornitore) utilizzando il motore della galleria una volta revisionato.
Anche in questo caso, il collaudo avverrà in due fasi:
   - o Con comando dell'azionamento da pannello locale;
   - o Con comando dell'azionamento da controllo remoto della galleria.

Sarà verificato il regolare, inteso con riferimento ai requisiti espressi in precedenza, comportamento dell'azionamento nell'intero campo di velocità richiesto. Saranno simulate condizioni d'emergenza, per verificare l'intervento delle protezioni e delle segnalazioni come previsto sopra in questo documento.

6. TEMPISTICA ED EVENTI

Il completamento della fornitura dovrà avvenire entro 3 mesi dall'accettazione, da parte del Fornitore, dell'ordine emesso dal Committente per l'espletamento di quanto al presente capitolato.

La pianificazione degli eventi è la seguente:

Evento	Fase	Descrizione	Tempo	Documentazione da produrre
Ev. 1	KOM	Inizio attività	T0	- Cronoprogramma;
Ev. 2	DDR	Fine progettazione, emissione ordini	T0+1mese	- Schemi elettrici; - Rapporti verifiche in sito - Dimensionamento apparecchiature; - Programma prove in fabbrica - Programma prove in sito - Evidenza emissione ordini d'acquisto/fabbricazione apparecchiature
Ev. 3	Factory Tests	Collaudi in fabbrica, accettazione preliminare	T0+2mesi	- Rapporto prove in fabbrica
Ev. 4	AR	Fine collaudi in sito, accettazione finale	T0+3mesi	- Rif. par. 3.2.1. "documentazione tecnica finale)

7. GESTIONE DELLA COMMESSA

Al ricevimento dell'ordine il fornitore assegnerà al progetto un Project Manager con il compito di coordinare un team di persone competenti, sia dal punto di vista tecnico che amministrativo e responsabile di portare a termine con successo il contratto, fungendo da punto focale nel coordinamento dei vari aspetti del progetto stesso.
Qualunque contatto con il fornitore che coinvolge aspetti contrattuali e/o finanziari, dovrà avvenire attraverso il Project Manager. Sono previsti incontri tra il P.M. e il CIRA finalizzati ad approvare eventuale revisioni della documentazione, la definizione delle procedure di comunicazione, la definizione e revisione delle date di completamento delle varie fasi del progetto, la definizione dei rispettivi compiti e responsabilità.
Il Project Manager verrà affiancato da un Project Team. Il Project Team resta associato al progetto finchè il sistema è installato e funzionante e, comunque, finchè gli obiettivi del contratto non sono completamente soddisfatti.

8. DOCUMENTAZIONE

Per consentire lo sviluppo delle attività sopra citate il CIRA consentirà al fornitore, ove questi ne faccia richiesta, di consultare la documentazione esistente relativa alle componenti da sostituire.
Prima della presentazione dell'offerta il fornitore avrà facoltà di esaminare il sistema attualmente installato e la documentazione relativa al fine verificare le interfacce ed assicurare la compatibilità sia HW che SW con la fornitura proposta. La responsabilità del corretto funzionamento del sistema al termine delle operazioni resta integralmente a carico del fornitore che nell'offerta deve specificare di avere preso visione del sistema esistente ed assicurare la compatibilità.

Al termine dell'attività il fornitore produrrà la seguente documentazione "As Built":

- disegni della distribuzione elettrica
- CD con la configurazione del sistema
- elenco materiali
- Manuali di istruzione
- Procedure di utilizzo del SW
- Piano di manutenzione
- Elenco ricambi critici

9. Penali

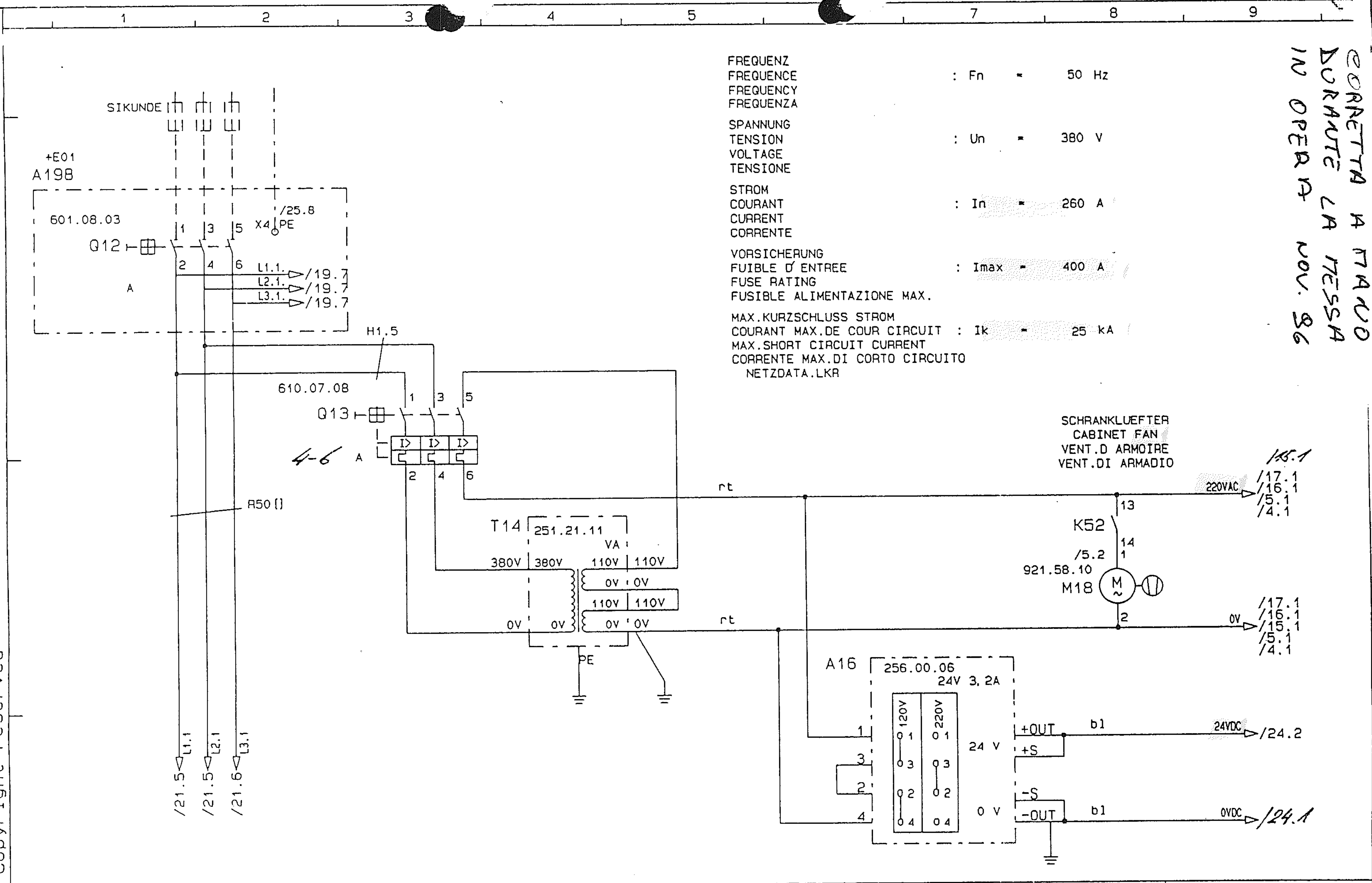
In caso di ritardato completamento dell'intervento, per cause imputabili all'Assuntore, saranno applicate le penali secondo quanto previsto dal documento CIRA-CF-07-0780 rev. 0 "Condizioni Generali per i Contratti di Fornitura CIRA".

10. Garanzia

Per tutto quanto indicato nella presente specifica si richiede un periodo di garanzia on site di 3 anni a partire dalla data di consegna. Tale garanzia, in aggiunta a quanto specificato dalle vigenti norme di legge e dalle condizioni generali di fornitura del CIRA, deve comprendere l'assistenza on line e/o telefonica sui SW forniti.

ALLEGATI

- SCHEMA QUADRO ELETTRICO,
- MANUALE INVERTRON REO,
- MANUALE INVERTRON VxI POWER UNIT,
- MANUALE INVERTRON VCI,
- LAYOUT VIBRACONTROL,
- CARATTERISTICHE MOTORE



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RELIANCE ELECTRIC Dierikon

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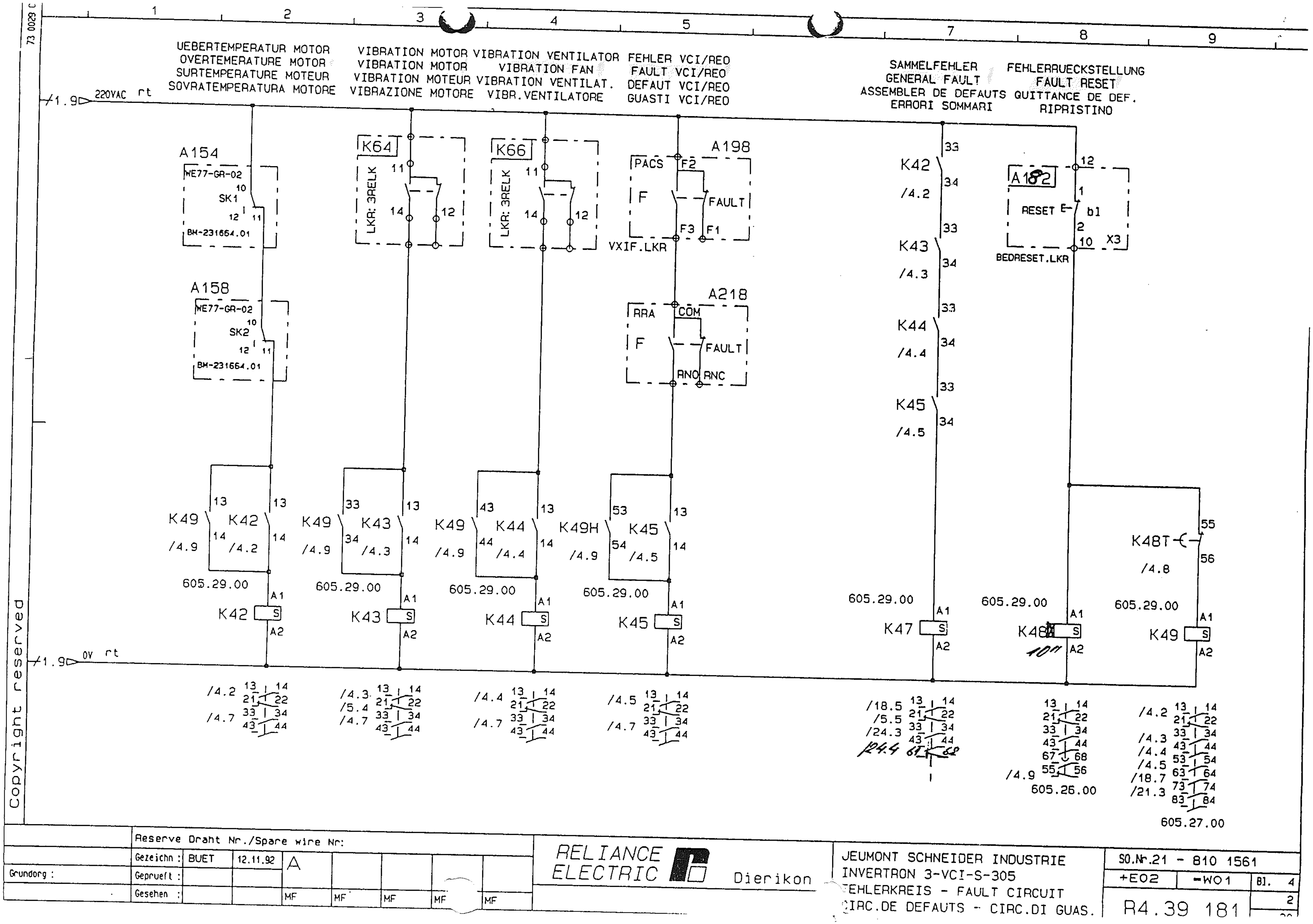
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OVERTEMERATURE MOTOR
SURTEMPERATURE MOTEUR
SOVRATEMPERATURA MOTORE
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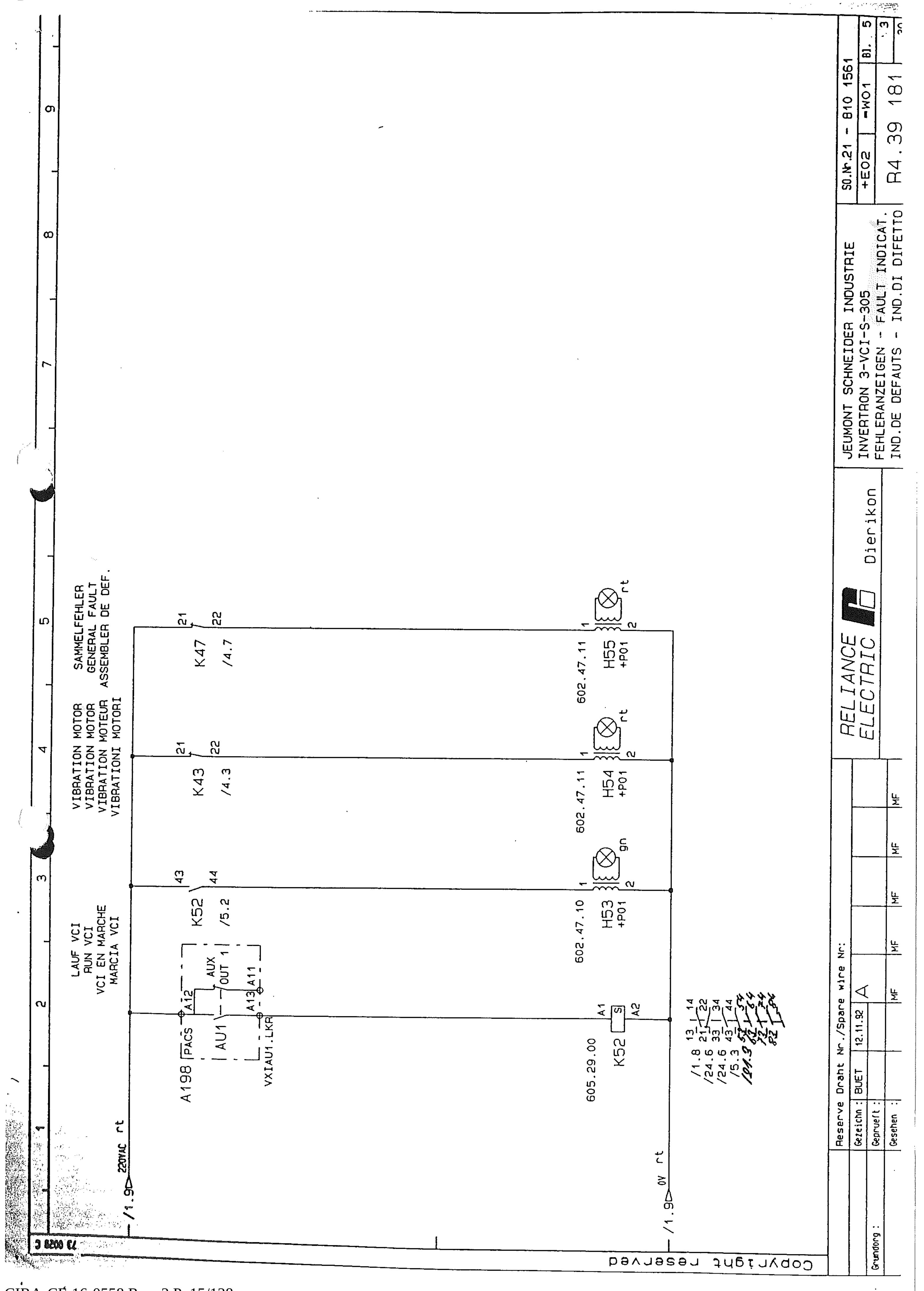
VIBRATION MOTOR
VIBRATION MOTEUR
VIBRAZIONE MOTORE
VIBRATION VENTILATOR
VIBRATION FAN
VIBRATION VENTILAT.
VIBR.VENTILATORE
FEHLER VCI/REO
FAULT VCI/REO
DEFAUT VCI/REO
GUASTI VCI/REO
SAMMELFEHLER
GENERAL FAULT
ASSEMBLER DE DEFAUTS
ERRORI SOMMARI
FEHLERRUECKSTELLUNG
FAULT RESET
QUITTANCE DE DEF.
RIPRISTINO
/1.9 220VAC rt
/1.9 0V rt
A154
WE77-GR-02
SK1
BM-231664.01
A158
WE77-GR-02
SK2
BM-231664.01
K64
LKR: 3RELK
K66
LKR: 3RELK
A198
PACS
FAULT
VXIF.LKR
A218
RRA
COM
FAULT
RNO RNC
A182
RESET
b1
X3
BEDRESET.LKR
K42 /4.2
K43 /4.3
K44 /4.4
K45 /4.5
K49 /4.9
K49H /4.9
K48T /4.8
605.29.00
K42
K43
K44
K45
K47
K48
K49
605.26.00
605.27.00
Reserve Draht Nr./Spare wire Nr:
Gezeichn.: BUET 12.11.92 A
Geprueft :
Gesehen :
Grundorg :
MF
RELIANCE ELECTRIC
Dierikon
JEUMONT SCHNEIDER INDUSTRIE
INVERTRON 3-VCI-S-305
FEHLERKREIS - FAULT CIRCUIT
CIRC.DE DEFAUTS - CIRC.DI GUAS.
SO.Nr.21 - 810 1561
+E02
=W01
Bl. 4
2
R4.39 181
Copyright reserved
73 0029 C



LAUF VCI
RUN VCI
VCI EN MARCHE
MARCIA VCI
VIBRATION MOTOR
VIBRATION MOTOR
VIBRATION MOTEUR
VIBRATIONI MOTORI
SAMMELFEHLER
GENERAL FAULT
ASSEMBLER DE DEF.
220VAC rt
/1.9
0V rt
/1.9
A198
PACS
AU1
AUX OUT 1
VXIAU1.LKR
A12
A13
A11
K52
/5.2
K43
/4.3
K47
/4.7
605.29.00
K52
602.47.10
H53 +P01
602.47.11
H54 +P01
602.47.11
H55 +P01
gn
rt
rt
/1.8
/24.6
/24.6
/5.3
JEUMONT SCHNEIDER INDUSTRIE
INVERTRON 3-VCI-S-305
FEHLERANZEIGEN - FAULT INDICAT.
IND.DE DEFAUTS - IND.DI DIFETTO
SO.Nr.21 - 810 1561
+E02
-W01
Bl. 5
R4.39 181
RELIANCE ELECTRIC
Dierikon
Reserve Draht Nr./Spare wire Nr:
Gezeichn.: BUET 12.11.92
Geprueft:
Gesehen:
Grundorg.:
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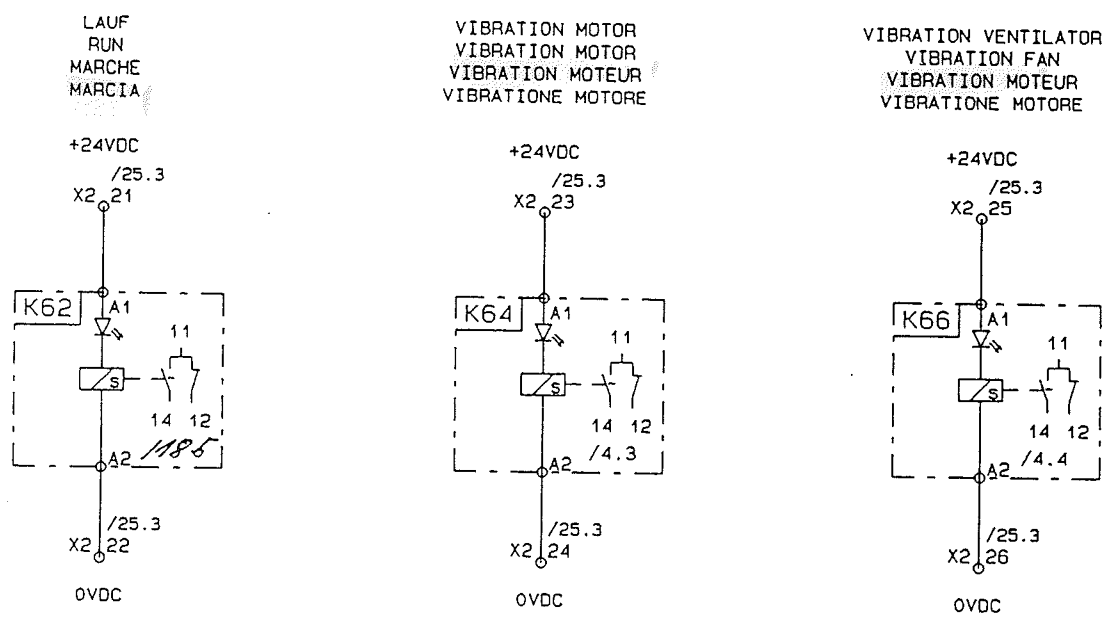


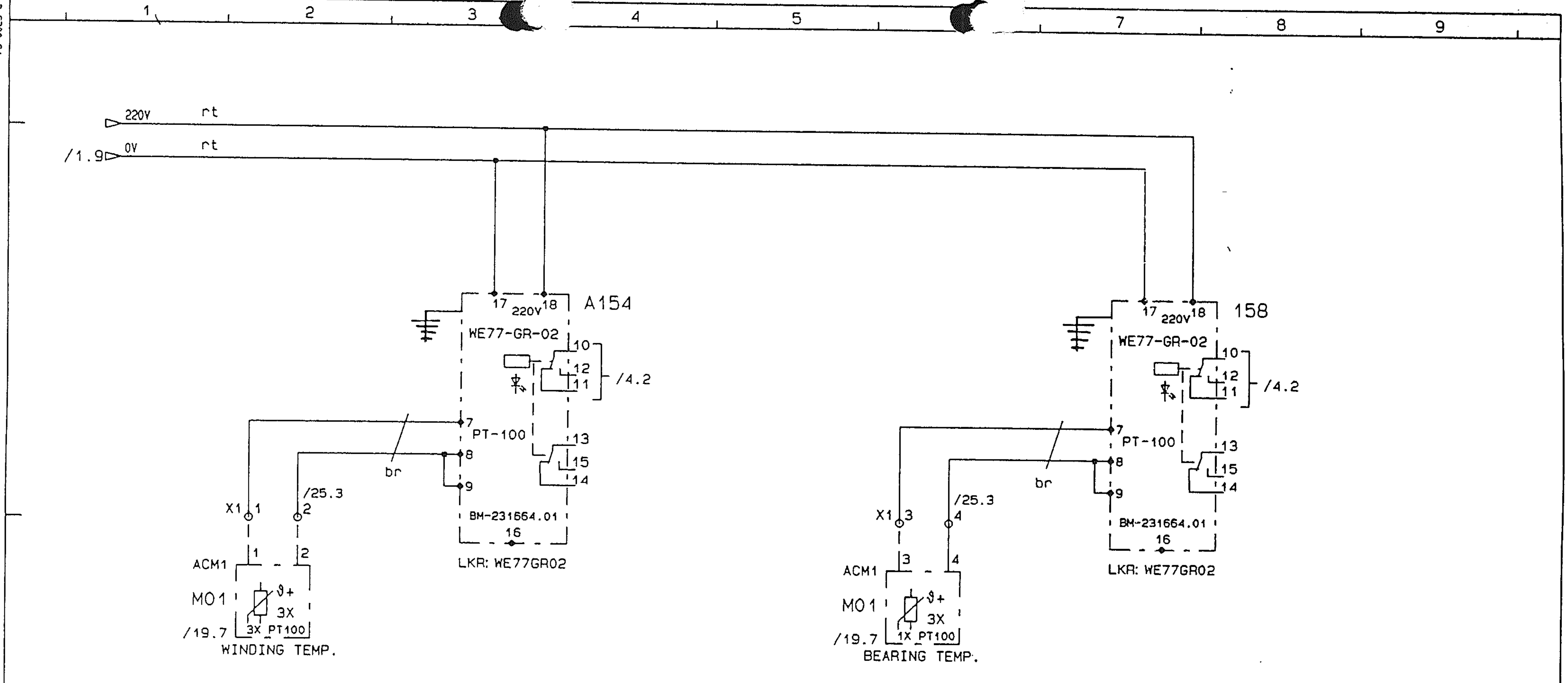
	Reserve Draht Nr./Spare wire Nr:								
	Gezeichn :	BUET	12.11.92	A					
Grundorg :	Geprueft :								
	Gesehen :			MF	MF	MF	MF	MF	

RELIANCE ELECTRIC

Dierikon

JEUMONT SCHNEIDER INDUSTRIE
INVERTRON 3-VCI-S-305
24V EINGAENGE - 24V INPUTS
24V ENTREES - 24V ENTRATA

S0.Nr.21 - 810 1561		
+E02	-W01	Bl. 6
R4.39 181		4
		30



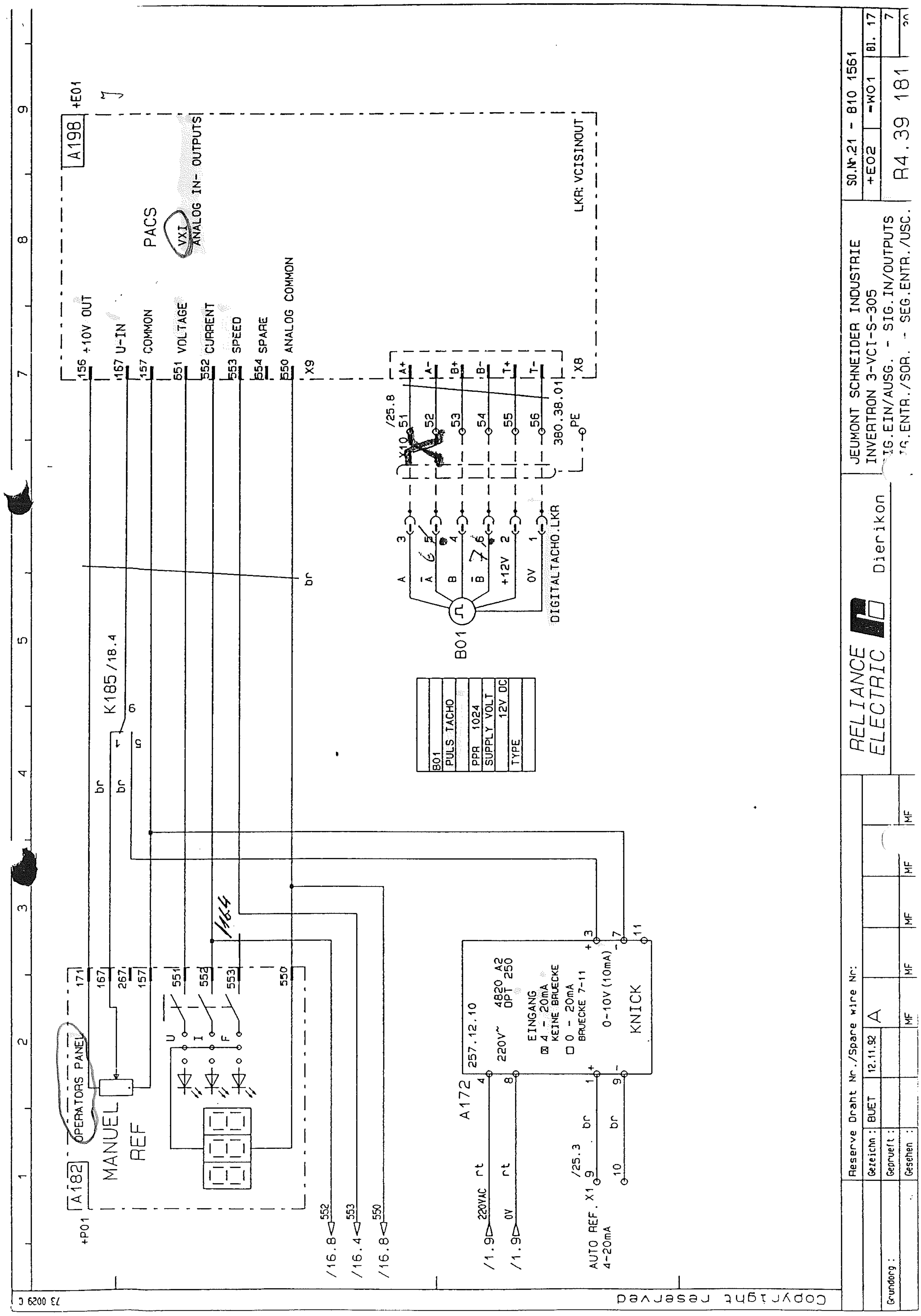
73 0029 C

	Reserve Draht Nr./Spare wire Nr:						
	Gezeichn :	BUET	12.11.92	A			
Grundorg :	Geprueft :						
	Gesehen :			MF	MF	MF	MF	MF

RELIANCE ELECTRIC Dierikon

JEUMONT SCHNEIDER INDUSTRIE
INVERTRON 3-VCI-S-305
MOTOR TEMP. / TEMPER.MOTOR
TEMP.MOTEUR / TEMP.MOTORE

SO.Nr.21 - 810 1561
+E02 -W01 Bl. 15
R4.39 181 5 30



A198 +E01
PACS
VXI
ANALOG IN- OUTPUTS
LKR: VCISINOUT
156 ±10V OUT
167 U-IN
157 COMMON
551 VOLTAGE
552 CURRENT
553 SPEED
554 SPARE
550 ANALOG COMMON
X9
X8
A+
A-
B+
B-
T+
T-
/25.8
X10
51
52
53
54
55
56
380.38.01
PE
DIGITALTACHO.LKR
A
Ā
B
B̄
+12V
0V
B01
br
K185/18.4
B01
PULS TACHO
PPR 1024
SUPPLY VOLT 12V DC
TYPE
A182
OPERATORS PANEL
MANUEL REF
+P01
171
167
267
157
551
552
553
550
U
I
F
257.12.10
4820 A2
OPT 250
220V~
EINGANG
☒ 4 - 20mA KEINE BRUECKE
☐ 0 - 20mA BRUECKE 7-11
0-10V (10mA)
KNICK
A172
rt
220VAC
0V
/1.9
/16.8
/16.4
AUTO REF. X1
4-20mA
/25.3
JEUMONT SCHNEIDER INDUSTRIE
INVERTRON 3-VCI-S-305
SIG.EIN/AUSG. - SIG.IN/OUTPUTS
SIG.ENTR./SOR. - SEG.ENTR./USC.
RELIANCE ELECTRIC
Dierikon
SO.Nr.21 - B10 1561
+E02
-W01
Bl. 17
7
R4.39 181
Reserve Draht Nr./Spare wire Nr:
Gezeichn.: BUET
12.11.92
A
Geprueft:
Gesehen:
Grundorg.:
MF
Copyright reserved
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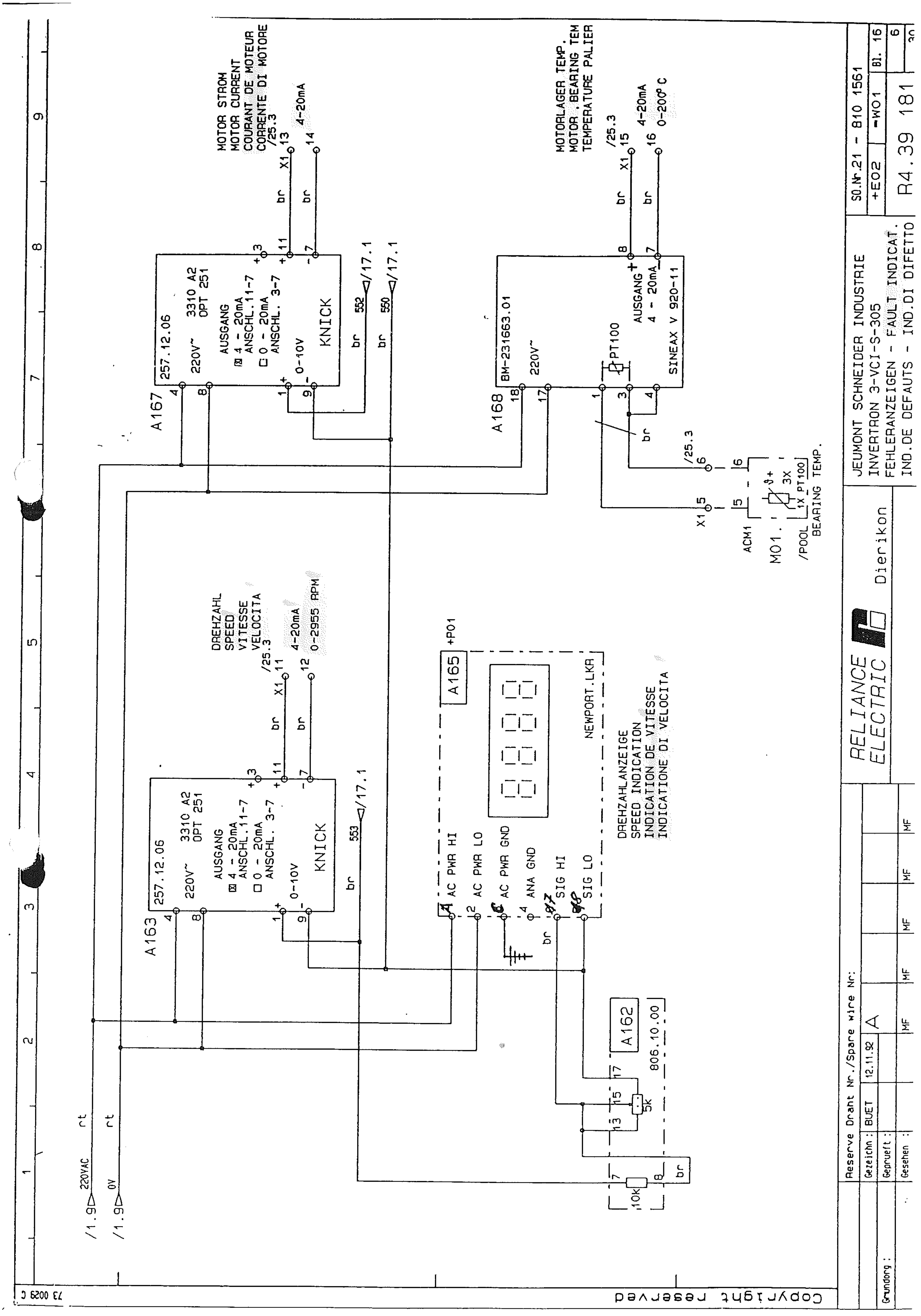
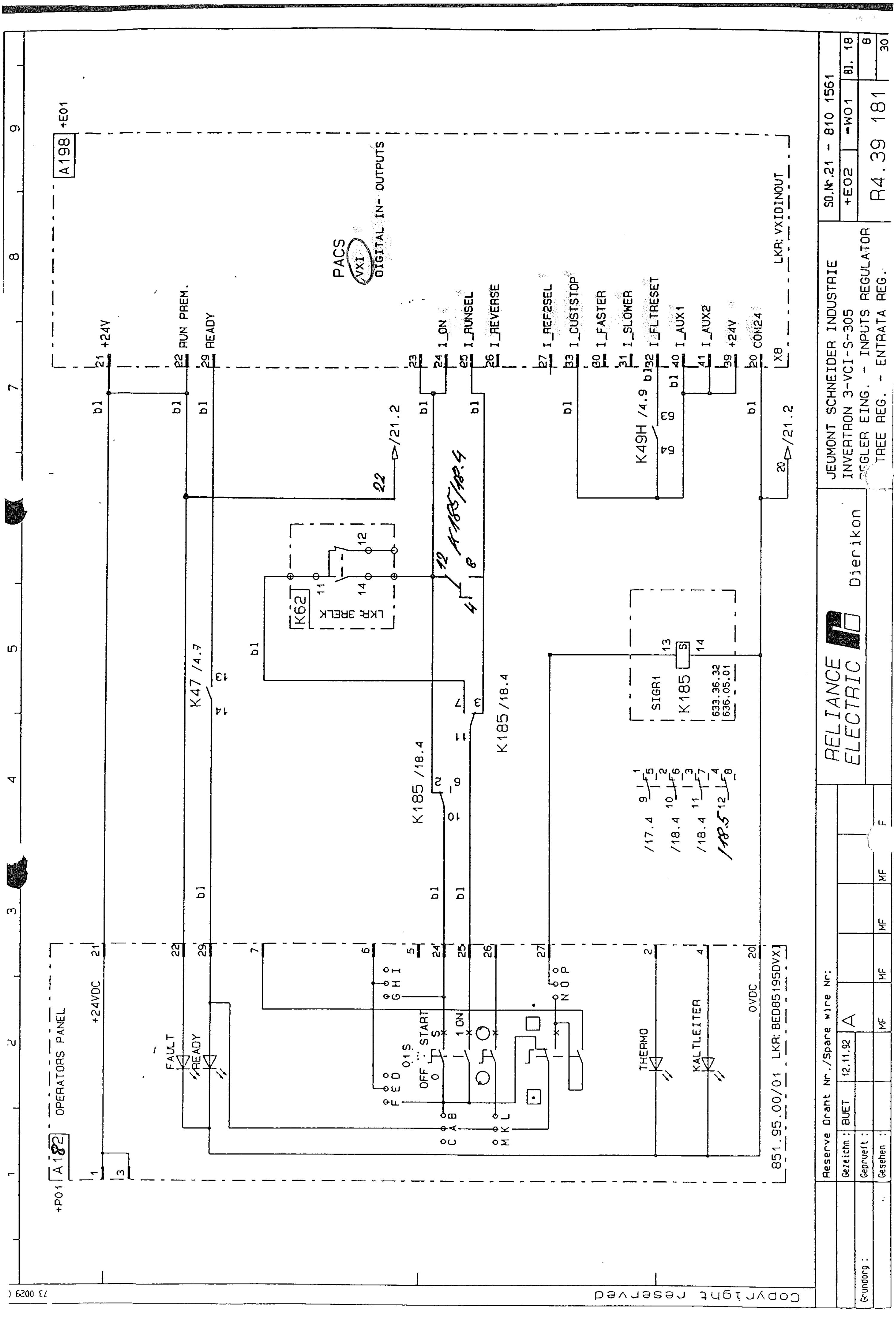

MOTOR STROM
MOTOR CURRENT
COURANT DE MOTEUR
CORRENTE DI MOTORE
4-20mA
MOTORLAGER TEMP.
MOTOR. BEARING TEM
TEMPERATURE PALIER
4-20mA
0-200° C
A167
257.12.06
220V~
3310 A2
OPT 251
AUSGANG
☒ 4 - 20mA
ANSCHL.11-7
☐ 0 - 20mA
ANSCHL. 3-7
0-10V
KNICK
A168
BM-231663.01
220V~
PT100
AUSGANG
4 - 20mA
SINEAX V 920-11
BEARING TEMP.
ACM1
M01.
/POOL
DREHZAHL
SPEED
VITESSE
VELOCITA
4-20mA
0-2955 RPM
A163
A165
+P01
AC PWR HI
AC PWR LO
AC PWR GND
ANA GND
SIG HI
SIG LO
NEWPORT.LKR
DREHZAHLANZEIGE
SPEED INDICATION
INDICATION DE VITESSE
INDICATIONE DI VELOCITA
A162
806.10.00
5k
10k
220VAC
0V
JEUMONT SCHNEIDER INDUSTRIE
INVERTRON 3-VCI-S-305
FEHLERANZEIGEN - FAULT INDICAT.
IND.DE DEFAUTS - IND.DI DIFETTO
RELIANCE ELECTRIC
Dierikon
SO.Nr.21 - 810 1561
+E02
-W01
Bl. 16
6
R4.39 181
Reserve Draht Nr./Spare wire Nr:
Gezeichn.: BUET
12.11.92
A
Geprueft:
Gesehen:
Grundorg.:
Copyright reserved


A198 +E01
PACS VXI DIGITAL IN- OUTPUTS
LKR: VXIDINOUT
+24V
RUN PREM.
READY
I_ON
I_RUNSEL
I_REVERSE
I_REF2SEL
I_CUSTSTOP
I_FASTER
I_SLOWER
I_FLTRESET
I_AUX1
I_AUX2
+24V
COM24
X8
/21.2
K49H /4.9
K62
LKR: 3RELK
K47 /4.7
K185 /18.4
SIGR1
K185
633.36.32
636.05.01
/17.4
/18.4
/18.4
A182 +P01
OPERATORS PANEL
+24VDC
FAULT
READY
OFF
START
1 ON
THERMO
KALTLEITER
0VDC
851.95.00/01 LKR: BED85195DVX
JEUMONT SCHNEIDER INDUSTRIE
INVERTRON 3-VCI-S-305
REGLER EING. - INPUTS REGULATOR
TREE REG. - ENTRATA REG.
SO.Nr.21 - 810 1561
+E02
-W01
Bl. 18
8
30
R4.39 181
RELIANCE ELECTRIC
Dierikon
Reserve Draht Nr./Spare wire Nr:
Gezeichn.: BUET
12.11.92
A
Geprueft:
Gesehen:
Grundorg.:
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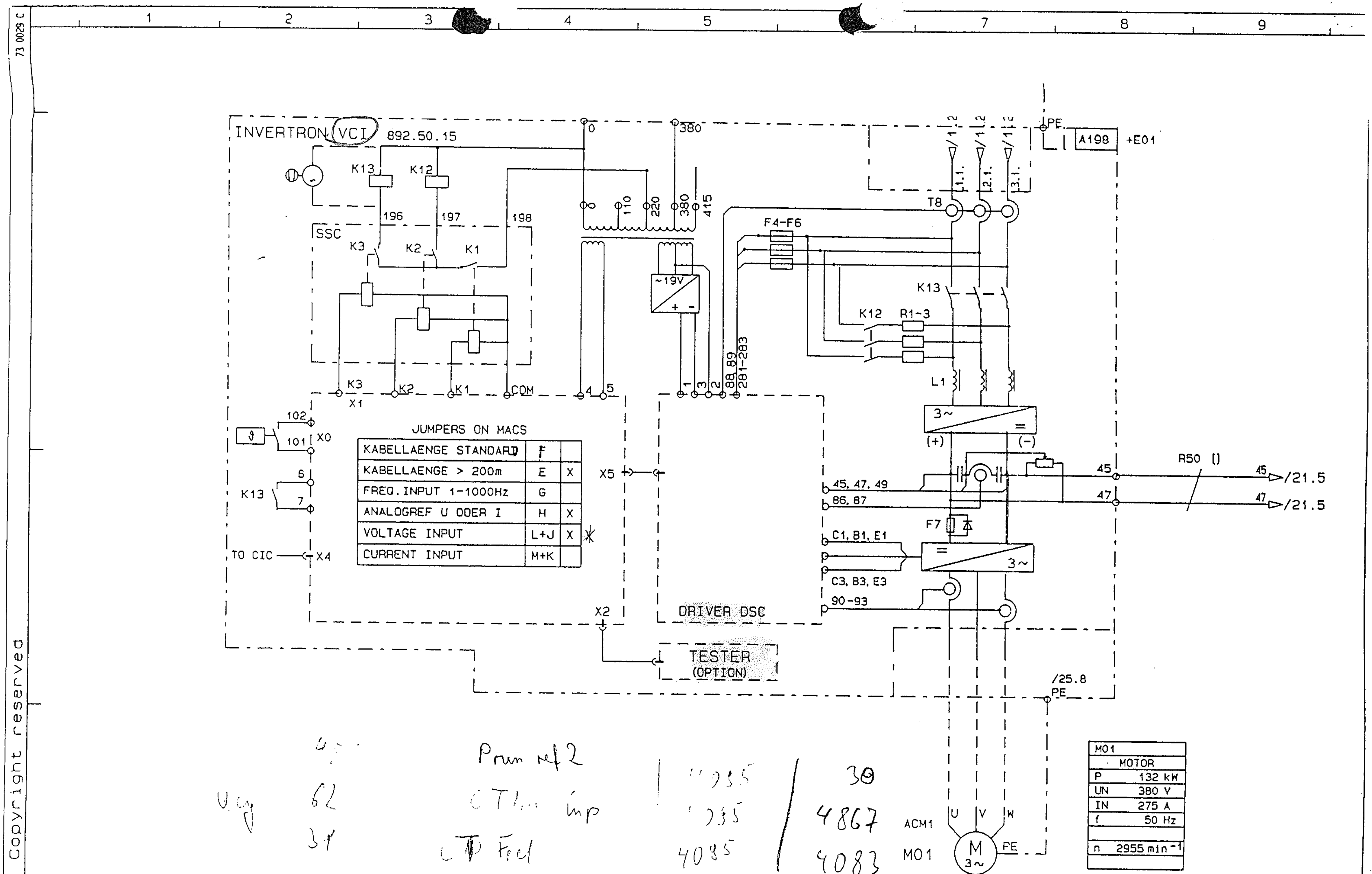


Prun ref 2

CT... inp

CTP Fed

Ug

62

31

4035

4035

4035

30

4867

4083

Reserve Draht Nr./Spare wire Nr:	
Gezeichn.: BUET	12.11.92
Geprueft:	A
Grundorg.:	

RELIANCE ELECTRIC Dierikon

JEUMONT SCHNEIDER INDUSTRIE
INVERTRON 3-VCI-S-305
LEISTUNGSTEIL - POWER UNIT

SO.Nr.21 - 810 1561
+E02 -W01 Bl. 19
9
R4 39 181

1 2 3 4 5 7 8 9

73 0029 C

EINSTELLUNGEN - MODIFIKATIONEN

REGISTER	NAME	BESCHREIBUNG	WERT	MODIFI.
263	MAX MOT TL	MOT.STROMBEGRENZ.	4096	
264	MAX REG TL	REK.STROMBEGRENZ.	4096	
267	NPR	PULSE / UMDREHUNG	1024	
268	N MAX	MAXIMALDREHZAHL	3000	
269	N NENN	NENNDREHZAHL	2955	
270	N BASEO	DREHZ.BEI FLUSSRED	2950	2896
~~272~~	~~POLP~~	~~POLZAHL / 2~~	~~2~~	
273	F NENN	FREQ.BEI NENNSPAN	50	
275	MOTOR I	MOTORNENNSTROM	2750	
276	MOTOR IZ	MOTORLEERLAUFSTROM	900	920
277	MOTOR U	MOTORNENNSPANNUNG	380	
280	MOT OL RAT	MOTORUEBERLASTVERH	150	138
300	U LINE	NETZSPANNUNG (V)	380	
305	PU MAX I	I MAX GERAET (*10)	WERKSEINSTELLUNG	
316	OVER S V1	UEBERDREHZAHLSCHW.	3500	3200
372	R ACC TIM	BESCHL.ZEIT (S*10)	100	
373	R DEC TIM	VERZ.ZEIT (S*10)	100	
489	P AUX1	REGIST.RELAIS 1	9	15
490	AUX1 BIT	BIT RELAIS 1	12	2
491	P AUX2	REGIST.RELAIS 2	512	
492	AUX2 BIT	BIT RELAIS 2	15	
530	KVPCTREQ	KVP Contr.!	0	

8→8
8→4

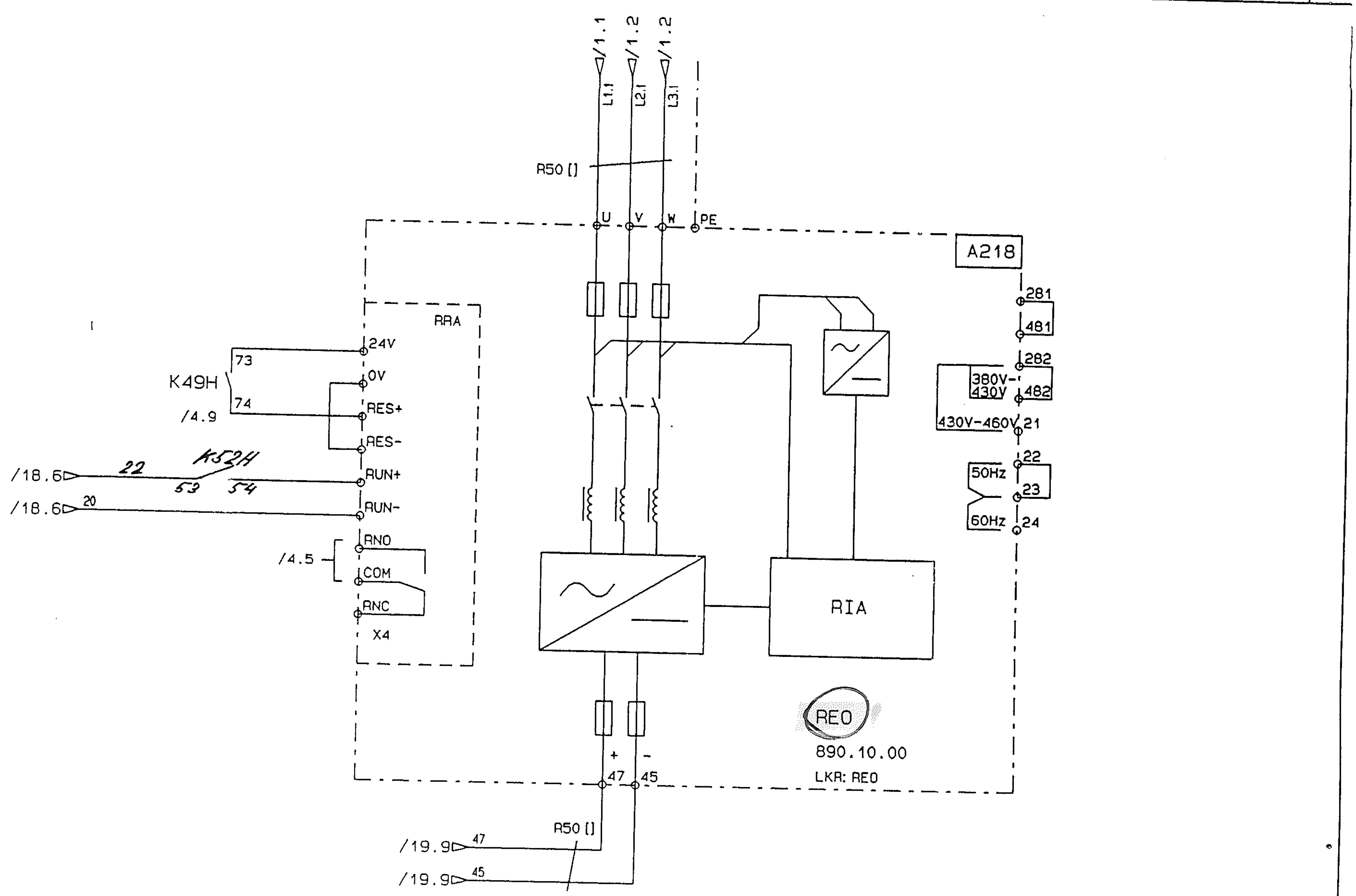
VCIEINSTELLTAB1.LKR

	Reserve Draht Nr./Spare wire Nr:								
	Gezeichn :	BUET	12.11.92	A					
Grundorg :	Geprueft :								
	Gesehen :			MF	MF	MF	MF	MF	

RELIANCE ELECTRIC Dierikon

JEUMONT SCHNEIDER INDUSTRIE
INVERTRON 3-VCI-S-305
EINSTELLUNGEN - ADJUSTEMENTS

SO.Nr.21 - 810 1561		
+E02	-W01	Bl. 20
R4.39 181		10



73 0029 C

Reserve Draht Nr./Spare wire Nr:							
Gezeichn :	BUET	12.11.92	A				
Geprueft :							
Gesehen :			MF	MF	MF	MF	MF

Grundorg :

RELIANCE ELECTRIC

Dierikon

JEUMONT SCHNEIDER INDUSTRIE
INVERTRON 3-VCI-S-305
LEISTUNGSTEIL - POWER UNIT
SECTION DE PUISSANCE - POTENZA

SO.Nr.21 - 810 1561		
+E02	-W01	Bl. 21
R4.39 181		11

V*I TYP	SICHERUNGSTRENNER EINBAUEN		EINBAUSATZ THERMO EINBAUEN		
021	839.26-02	[ ]	10-13A	839.36-01	[ ]
XXX. 46.02	BED.VGI/VCI 921.88.10	[ ]	13-18A	839.36-02	[ ]
			18-25A	839.36-03	[ ]
032	839.26-04	[ ]	23-32A	839.37-04	[ ]
XXX. 46.04	BED.VGI/VCI 921.88.10	[ ]	30-40A	839.37-05	[ ]
040	839.27-05	[ ]	30-40A	839.38-05	[ ]
XXX. 47.05	BED.VGI/VCI 921.88.15	[ ]	38-50A	839.38-05	[ ]
060	839.27-07	[ ]	38-50A	839.38.06	[ ]
XXX. 47.07	BED.VGI/VCI 921.88.15	[ ]	48-57A	839.39-07	[ ]
			57-66A	839.39-08	[ ]
088	839.27.09	[ ]	57-66A	839.39-08	[ ]
XXX. 47.09	BED.VGI/VCI 921.88.20	[ ]	63-80A	839.40.08	[ ]
			75-105A	605.87.00	[ ]
111	839.28-10	[ ]	75-105A	605.87.00	[ ]
XXX. 48.10	BED.VGI/VCI 921.88.20	[ ]	95-125A	605.87.01	[ ]
144	839.29.11	[ ]	100-140A	625.02.02	[ ]
XXX. 49.11	BED.VGI/VCI 921.88.30	[ ]	140-180A	625.02.03	[ ]
216	839.29.13	[ ]	140-180A	625.02.03	[ ]
XXX. 49.13	BED.VGI/VCI 921.88.30	[ ]	180-240A	625.02.04	[ ]
305 XXX. 50.15	BED.VGI/VCI 921.88.xx	[X]			[ ]
450	BED.VGI/VCI 921.88.xx VTI 890.55-17 VCI 894.50-17	[ ]			
XXX. 890. 892.	LEISTUNGSTEIL VTI VGI/VCI	[ ] [X]			
	BEDIENUNGSSTATION ALT 851.95-00 AUF TUERE [ ] 851.95-10 EXTERN [ ]		BEDIENUNGSSTATION NEU 851.95-01 AUF TUERE [X] 851.95-11 EXTERN [ ]		

VXIKOMPD.LKR NEU: 14.10.92

REO TRAFOANPASSUNG		BRUECKE	
NETZFREQUENZ:	50Hz	22-23	[X]
	60Hz	23-24	
NETZSPANNUNG:	380V...430V	281-481 und 282-482	[X]
	430V...460V	281-481 und 282-21	

REO REGLERANPASSUNG		BRUECKE b1	BRUECKE rt	
NETZFREQUENZ:	50Hz	50Hz		[X]
	60Hz	60Hz		
NETZSPANNUNG:	380V...430V	400V		[X]
	430V...460V	460V		
STROMBEGRENZUNG:	55kW		I / 1	[X]
	27kW		I / 2	

KOMPLREO.LKR

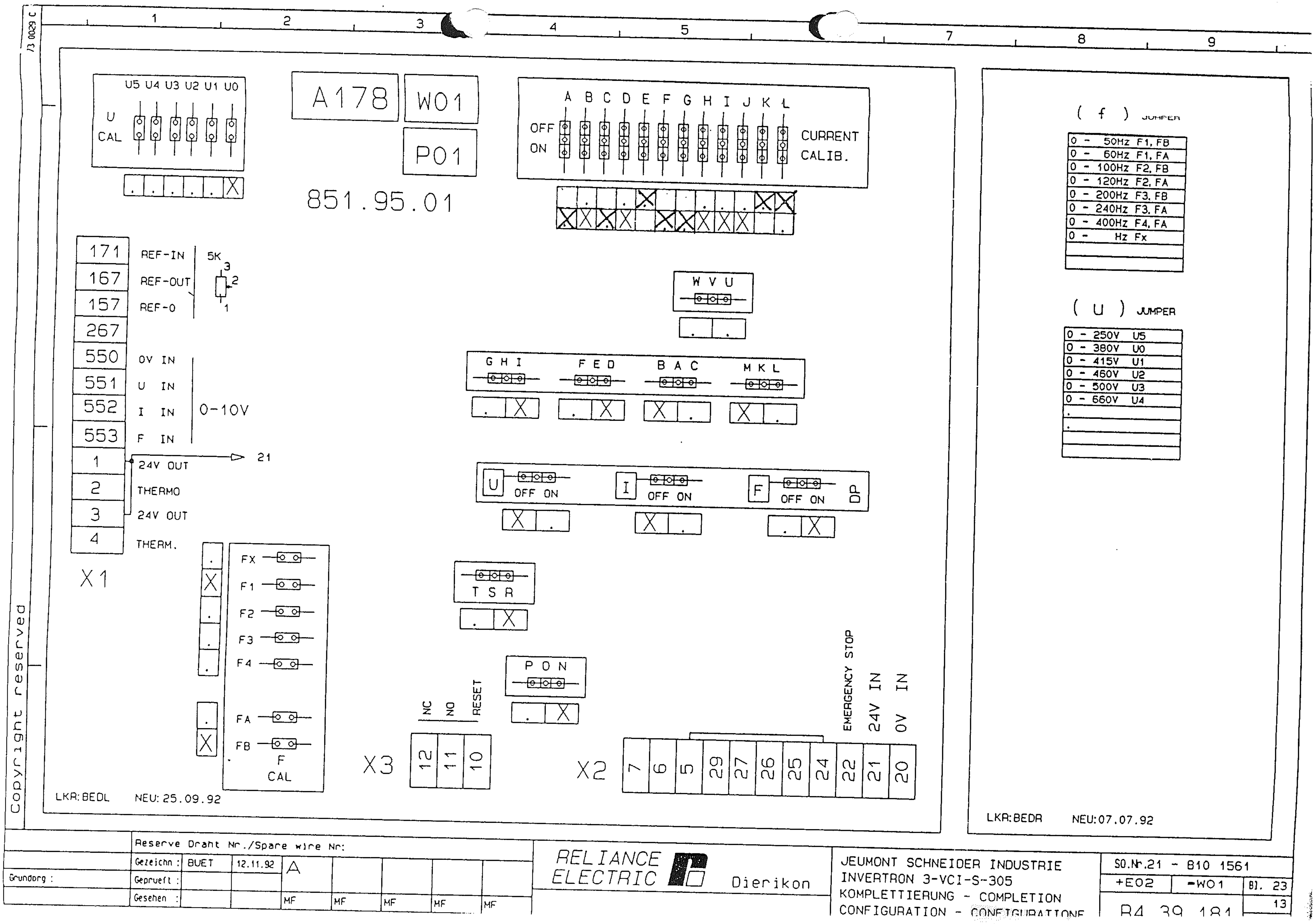
Reserve Draht Nr./Spare wire Nr:

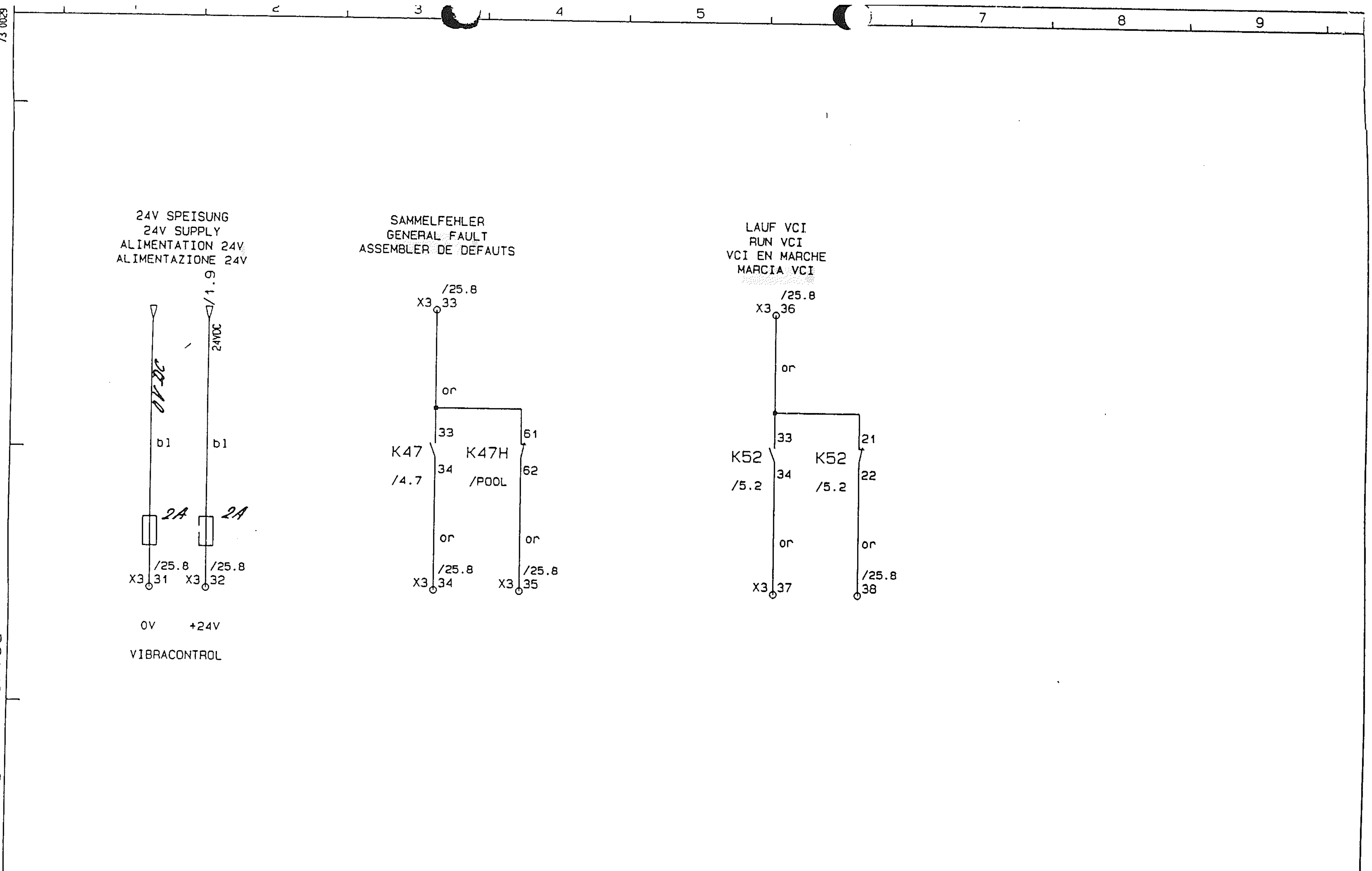
Gezeichn :	BUET	12.11.92	A					
Grundorg :	Geprueft :							
	Gesehen :			MF	MF	MF	MF	MF

RELIANCE ELECTRIC Dierikon

JEUMONT SCHNEIDER INDUSTRIE
INVERTRON 3-VCI-S-305
KOMPLETTIERUNG - COMPLETION
CONFIGURATION - CONFIGURATIONE

SO.Nr.21 - 810 1561
+E02 -WO1 Bl. 22
R4.39 181 12


U5 U4 U3 U2 U1 U0
U CAL
A178
W01
P01
851.95.01
A B C D E F G H I J K L
OFF
ON
CURRENT CALIB.
(f) JUMPER
0 - 50Hz F1, FB
0 - 60Hz F1, FA
0 - 100Hz F2, FB
0 - 120Hz F2, FA
0 - 200Hz F3, FB
0 - 240Hz F3, FA
0 - 400Hz F4, FA
0 - Hz Fx
(U) JUMPER
0 - 250V U5
0 - 380V U0
0 - 415V U1
0 - 460V U2
0 - 500V U3
0 - 660V U4
171 REF-IN
167 REF-OUT
157 REF-0
5K
267
550 0V IN
551 U IN
552 I IN
553 F IN
0-10V
1 24V OUT
21
2 THERMO
3 24V OUT
4 THERM.
X1
W V U
G H I
F E D
B A C
M K L
U OFF ON
I OFF ON
F OFF ON
DP
T S R
P O N
FX
F1
F2
F3
F4
FA
FB
F CAL
NC NO RESET
12 11 10
X3
EMERGENCY STOP
24V IN
0V IN
7 6 5 29 27 26 25 24 22 21 20
X2
LKR:BEDL NEU: 25.09.92
LKR:BEDR NEU:07.07.92
Copyright reserved
Reserve Draht Nr./Spare wire Nr:
Gezeichn.: BUET 12.11.92 A
Geprueft :
Gesehen :
Grundorg :
MF MF MF MF MF
RELIANCE ELECTRIC
Dierikon
JEUMONT SCHNEIDER INDUSTRIE
INVERTRON 3-VCI-S-305
KOMPLETTIERUNG - COMPLETION
CONFIGURATION - CONFIGURATIONS
S0.Nr.21 - 810 1561
+E02 -W01
Bl. 23
13
R4 39 181



	Reserve Draht Nr./Spare wire Nr:							RELIANCE ELECTRIC Dierikon	JEUMONT SCHNEIDER INDUSTRIE INVERTRON 3-VCI-S-305 KUNDENKONTAKTE - CUSTOM.CONT. CONT.DE CLIENT - CON.DI CLIENTE
	Gezeichn :	BUET	12.11.92	A					
Grundorg :	Geprueft :								
	Gesehen :			MF	MF	MF	MF	MF	

S0.Nr.21 - 810 1561		
+E02	-W01	Bl. 24
R4.39 181		14
		30

73 0029

1 2 3 4 5 7 8 9

X1 — WEIDMUELLER 4 []

		SIGNAL	SIGNAL	SIGNAL
PE				
1	/15.2	WICKLUNGSTEMP.	WINDING TEMP.	TEMP.BOBINAGE
2	/15.2	WICKLUNGSTEMP.	WINDING TEMP.	TEMP.BOBINAGE
PE				
3	/15.6	LAGERTEMPERATUR	BEARING TEMP.	TEMPERATURE PALIER
4	/15.6	LAGERTEMPERATUR	BEARING TEMP.	TEMPERATURE PALIER
PE				
5	/16.6	LAGERTEMPERATUR	BEARING TEMP.	TEMPERATURE PALIER
6	/16.6	LAGERTEMPERATUR	BEARING TEMP.	TEMPERATURE PALIER
PE				
7		VIBRATION MOTOR	VIBRATION MOTOR	VIBRATION DE MOT.
8		VIBRATION MOTOR	VIBRATION MOTOR	VIBRATION DE MOT.
PE				
9	/17.1	SOLLWERT 4-20mA	REFERENCE 4-20 mA	REFERENCE 4-20 mA
10	/17.1	SOLLWERT 4-20mA	REFERENCE 4-20 mA	REFERENCE 4-20 mA
PE				
11	/16.5	DREHZAHL MOTOR	SPEED MOTOR	VITESSE DE MOTEUR
12	/16.5	DREHZAHL MOTOR	SPEED MOTOR	VITESSE DE MOTEUR
PE				
13	/16.9	MOTOR STROM	MOTOR CURRENT	COURANT DE MOTEUR
14	/16.9	MOTOR STROM	MOTOR CURRENT	COURANT DE MOTEUR
PE				
15	/16.9	LAGERTEMP.MOTOR	BEARING TEMP.MOT.	TEMPERATURE PALIER
16	/16.9	LAGERTEMP.MOTOR	BEARING TEMP.MOT.	TEMPERATURE PALIER

X2 — PHOENIX KLEMMENRELAIS

		STEUERUNG	CONTROL	COMAND
PE				
21	/6.2	LAUF VCI	RUN VCI	MARCHE VCI
22	/6.2	LAUF VCI	RUN VCI	MARCHE VCI
23	/6.4	VIBRATION MOTOR	VIBRATION MOTOR	VIBRATION MOTEUR
24	/6.4	VIBRATION MOTOR	VIBRATION MOTOR	VIBRATION MOTEUR
25	/6.6	VIBRATION VENT.	VIBRATION FAN	VIBRATION VENT.
26	/6.6	VIBRATION VENT.	VIBRATION FAN	VIBRATION VENT.

X3 — WEIDMUELLER 4 []

		KUNDENKONTAKTE	CUSTOMERS CONT.	CONTACT PAR CLIENT
PE			SUPPLY 24VDC	ALIMENTATION 24VDC
31	/24.1	SPEISUNG 24VDC	SUPPLY 24VDC	ALIMENTATION 24VDC
32	/24.2	SPEISUNG 24VDC		
PE				
33	/24.3	SAMMELFEHLER	GENERAL FAULT	ASS.DE DEFAUTS
34	/24.3	SAMMELFEHLER	GENERAL FAULT	ASS.DE DEFAUTS
35	/24.4	SAMMELFEHLER	GENERAL FAULT	ASS.DE DEFAUTS
36	/24.6	LAUF VCI	RUN VCI	VCI EN MARCHE
37	/24.6	LAUF VCI	RUN VCI	VCI EN MARCHE
38	/24.6	LAUF VCI	RUN VCI	VCI EN MARCHE

X4

		LEISTUNG	POWER	PUISSANCE
PE	/1.2			
L1		NETZEINGANG	LINE INPUT	ENTREE DE RESEAU
L2		NETZEINGANG	LINE INPUT	ENTREE DE RESEAU
L3		NETZEINGANG	LINE INPUT	ENTREE DE RESEAU
PE	/19.7			
U		MOTOR	MOTOR	MOTEUR
V		MOTOR	MOTOR	MOTEUR
W		MOTOR	MOTOR	MOTEUR

X10 — WEIDMUELLER 4 []

		TACHO
PE	/17.7	
51	/17.7	A+
52	/17.7	A-
53	/17.7	B+
54	/17.7	B-
55	/17.7	+12V
56	/17.7	0V

3 0029 C

	Reserve Draht Nr./Spare wire Nr:							
Grundorg :	Gezeichn :	BUET	12.11.92	A				
	Geprueft :							
	Gesehen :			MF	MF	MF	MF	MF

RELIANCE ELECTRIC Dierikon

JEUMONT SCHNEIDER INDUSTRIE
INVERTRON 3-VCI-S-305
KLEMMENPLAN - TERMINALS
PLAN DE BORNIER - TERMINALE

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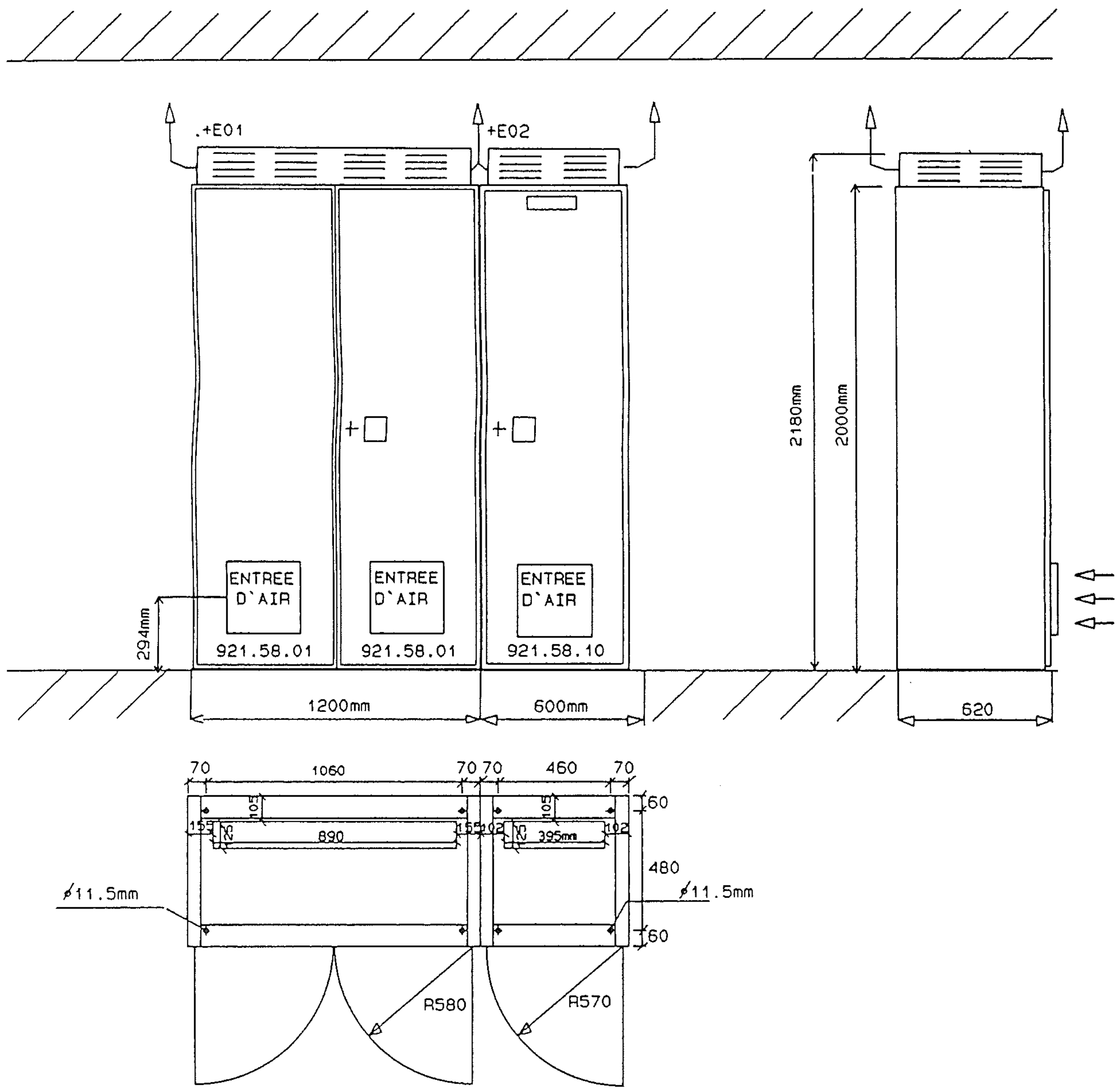

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KOMPLETTIERUNG SCHRANK

X	FIRMENSCHILD	925.50.11	
	PRINZIPSCH.CSI	926.35.00	TUERE E01 INNEN
	BLITZPFEILSCH.	928.50.01	AUF ABDECKUNGEN
X	BLITZPFEILSCH.	927.37.00	BEIM NETZEINGANG
X	WARNSCHIELD	927.37.02	NEBEN TUERSCHLOSS
X	SEKTIONSSCHILD		+E01/+E02
X	VERDRAHTUNG	NORMAL	
	VERDRAHTUNG	FARBIG	
	VERDRAHTUNG	UL/UR-CSA	
X	NICHTBEZEICHN.	QUERSCHNITTE 1mm2	
X	ADERENDHUELSEN		
X	TUEREN - PANELS	HALBFABR.ERDEN	
X	HAUPTSCHALTER	MIT KUPPLUNGSGRIFF	
X	BED.ELEMENTE	AUF TUERE ABDECKEN	E02
	SCHUTZART IP..		
	DACH GESCHLOSS.		
	LUEFTERDACH		
X	ABLUFTHAUBE	S1.934.44.01/02	
	FILTEREINHEIT	S1.921.58/2	TUERE UNTEN
	DACHLUEFT. IP54		
X	TUERVENTILATION	S1.921.58/2-3	ANSAUGEND UNTEN
	SCHRANKHEIZUNG	R2.66.390/1	UNTEN RECHTS
	SCHRANKHEIZUNG	R2.66.390/1	UNTEN LINKS
	STEUERSP.220V	1.5mm2	
	SCHRANKBELEUCHT	R2.66.246/1	
	TUERENDSCHALTER	R3.56.022/1	
	MAGN.TUERVERRI.	R1.61.407/1	
	SAMMELSCHIENEN	R1.66.176/1	AUF SCHRANKDACH
	SAMMELSCHIENEN	R1.66.176/2	IM AUFSATZKASTEN
X	WARNSCHILD	927.34.00	PHASENFOLGE BEACHT
	TRANSPORTKLEMM.	R1.61.641/2	
	ANORDN.KLEMMEN	R3.67.697	CSI 600
	SAMMELSCHIENEN	R3.67.698	CSI 600
		R3.67.699	CSI 600
		R3.67.700	CSI 600

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JEUMONT SCHNEIDER INDUSTRIE
INVERTRON 3-VCI-S-305
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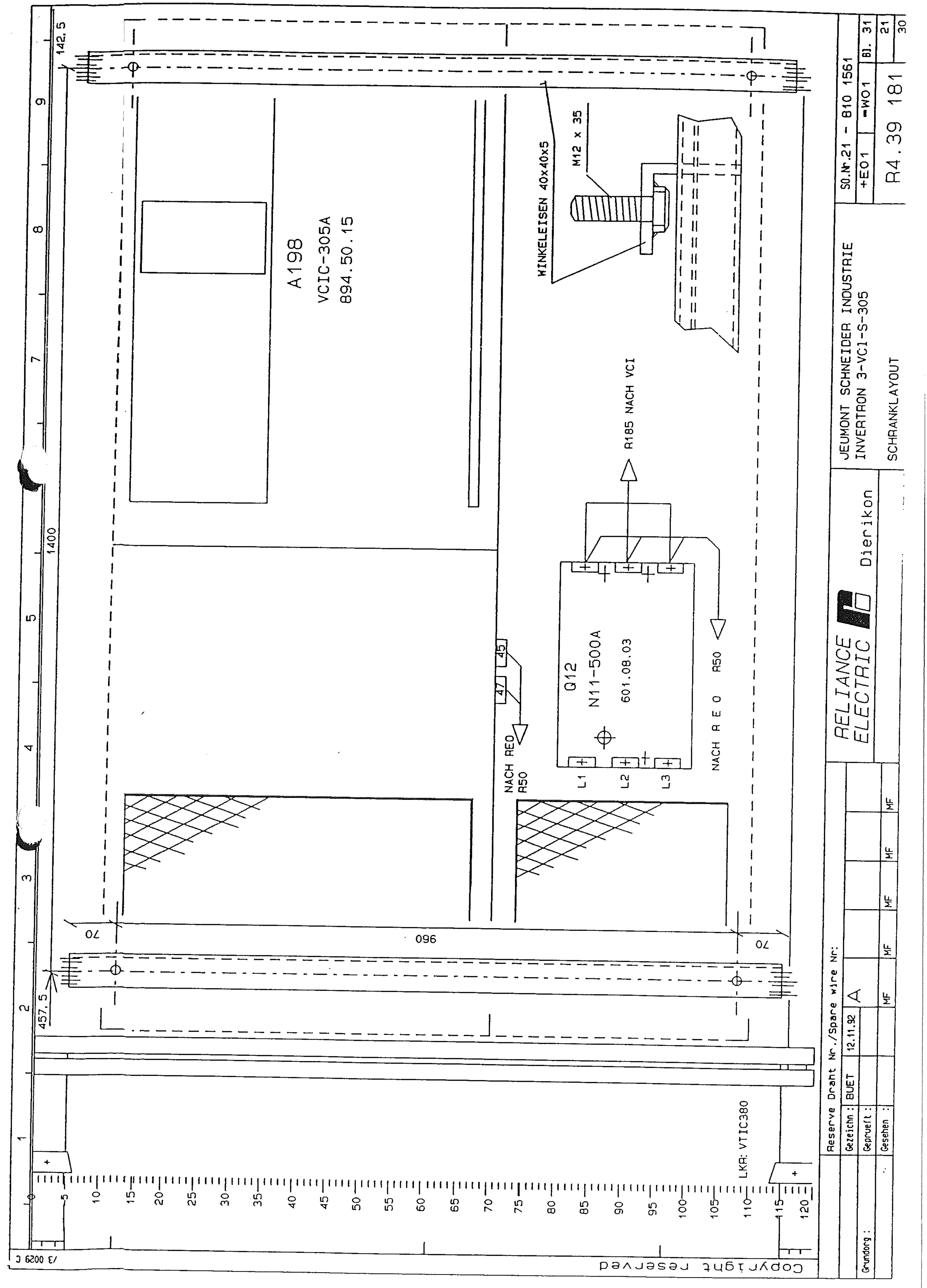
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NACH REO R50
L1
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L3
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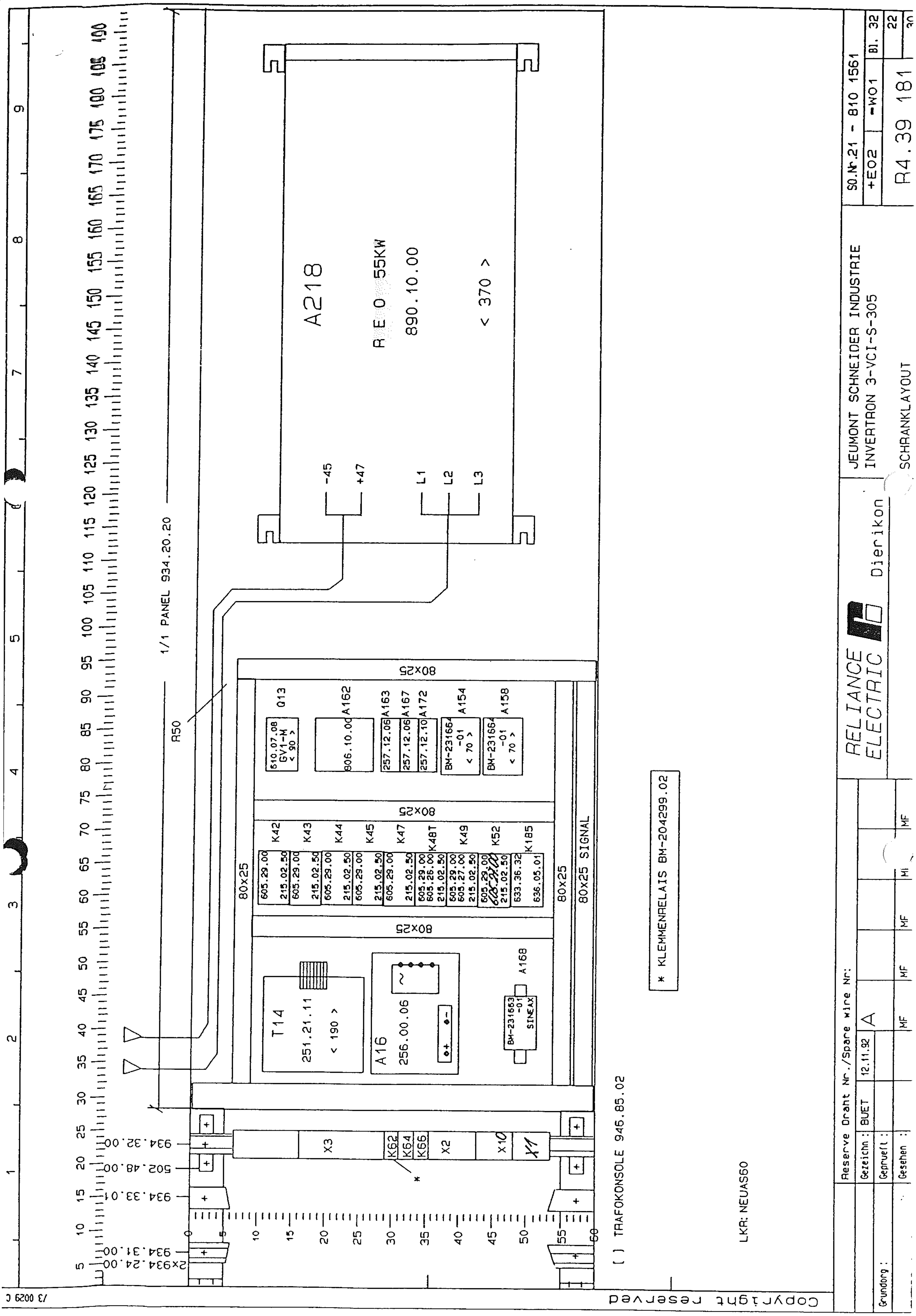A218
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+47
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L2
L3
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R50
80x25
Q13
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-01
SINEAX
* KLEMMENRELAIS BM-204299.02
934.32.00
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934.33.01
934.31.00
2x934.24.00
X3
K62
K64
K66
X2
X10
X1
TRAFOKONSOLE 946.85.02
LKR: NEUAS60
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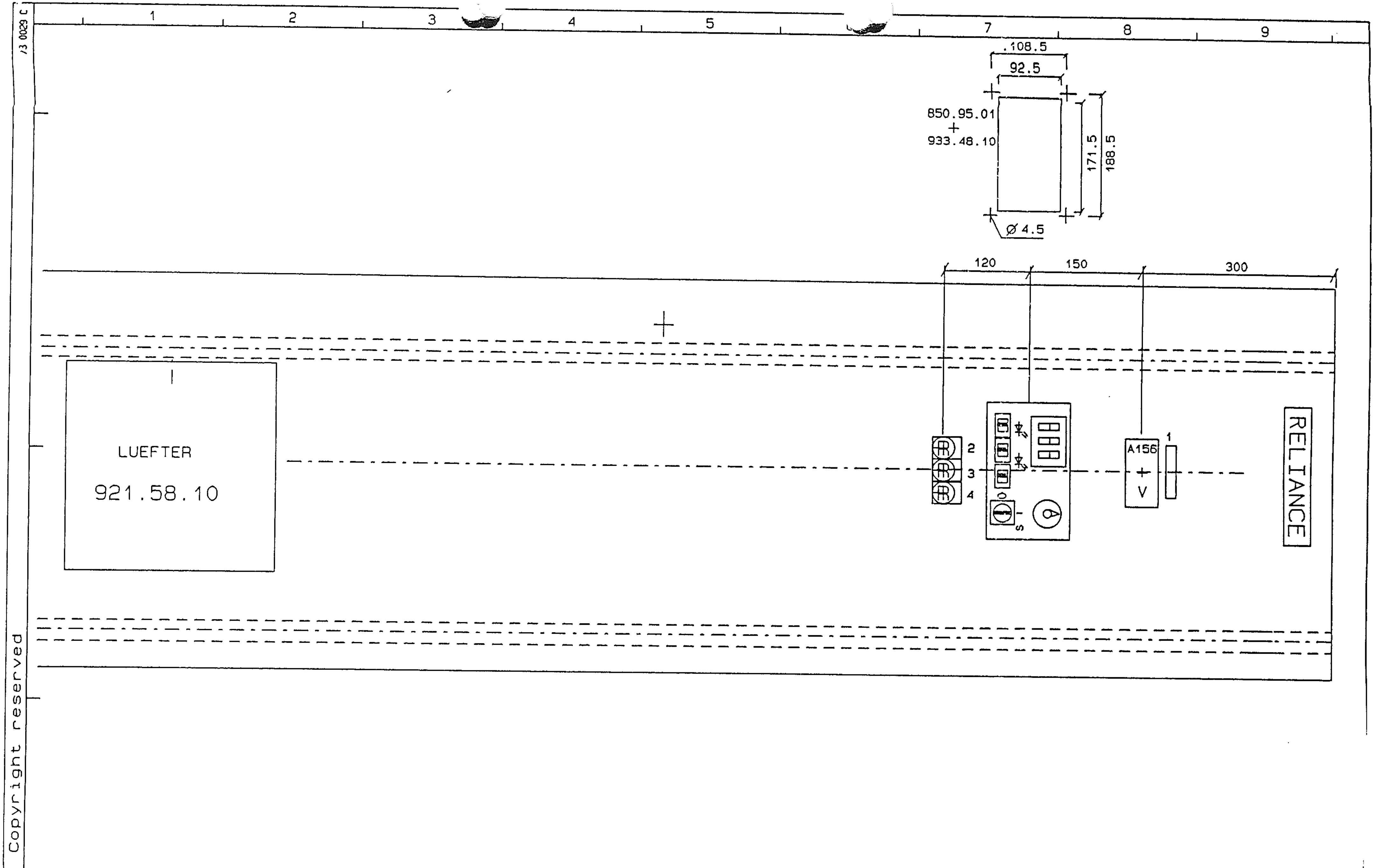

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INVERTRON 3-VCI-S-305

SCHRANKLAYOUT

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1 2 3 4 5 6 7 8 9

BEDIENUNGSELEMENTE UND GRAVUREN

POSIT.	KURZB.	DEUTSCH [ ]	ENGLISCH [ ]	ITALIENISCH [X]	LAGER NR. FARBE	SCHILD NR.
1	A178	DREHZAHL	SPEED	VELOCITA	BM-	925.01.10
2	H53	LAUF	RUN	MARCIA	602.47.11	603.93.01
3	H55	SAMMELFEHLER	GENERAL/FAULT	ERRORI/SOMMARI	602.47.11	603.93.01
4	H54	VIBRATION/MOTOR	VIBRATION/MOTOR	VIBRAZIONE/MOTORE	602.47.11	603.93.01
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						

SCHILD 925.01.10 (52x13) SCHRIFTHOEHE 3mm
SCHILD 925.01.11 (74x13) SCHRIFTHOEHE 5mm
SCHILD 603.93.01 (30x40) SCHRIFTHOEHE 3mm
NACH / NEUE LINIE !!

LKR: TUERE20106G

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Grundorg :	Geprueft :								
	Gesehen :			MF	MF	MF	MF	MF	

RELIANCE ELECTRIC Dierikon

JEUMONT SCHNEIDER INDUSTRIE
INVERTRON 3-VCI-S-305

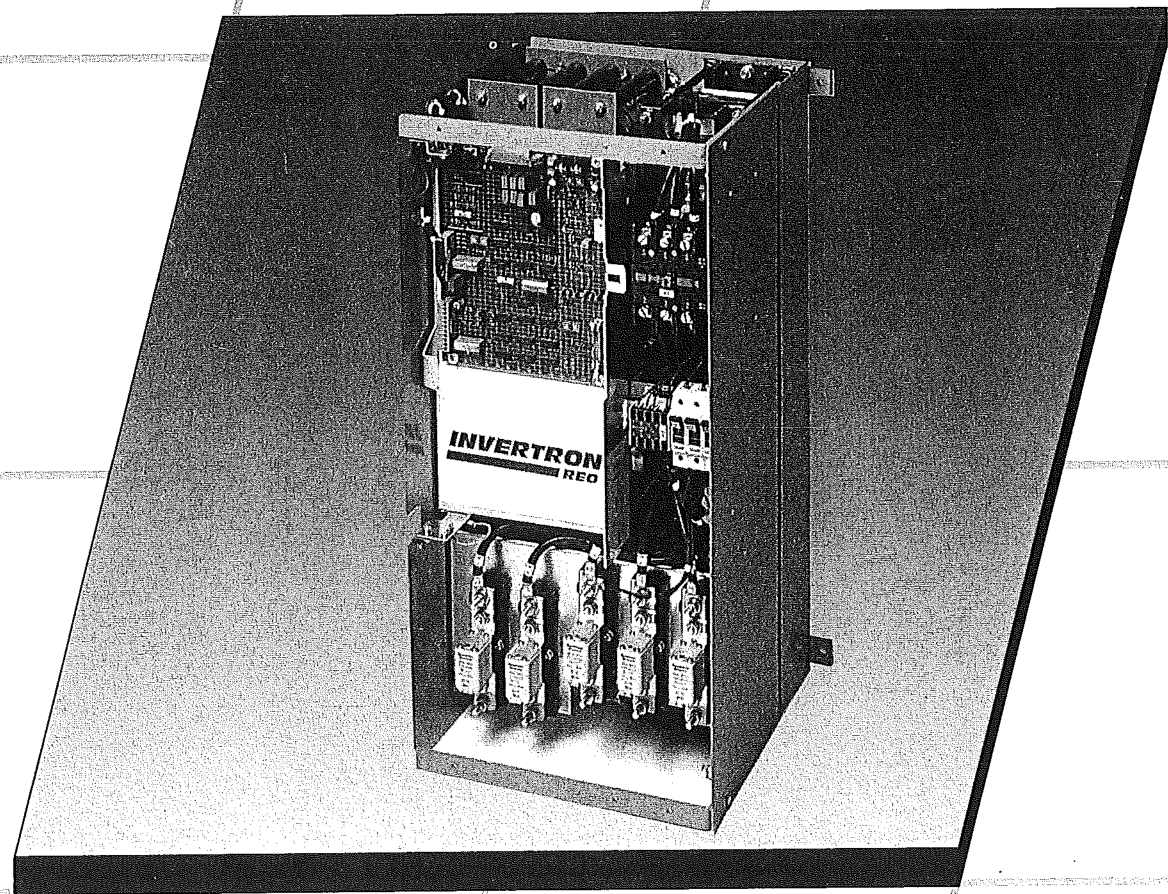
BEZEICHNUNGEN

SO.Nr.21 - 810 1561		
+E02	-W01	Bl. 34
R4.39 181		24-30
		30

INVERTRON
REO

Instruction manual
Betriebsanleitung
Instructions de service
Istruzioni di servizio
Manual de instrucciones

Power Unit - REO
per consentire al VSI
di lavorare in tutti e 4 quadranti.



RELIANCE ELECTRIC

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Chapter/Topic Page

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Power unit 6
Control 7
Protection concept 8
Diagnostic 9

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Minimum power of the inverter 14

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Separate supply for the control transformer 15
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Preoperative checks with power off 18
Preoperative checks with mains voltage applied 18
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Trouble shooting 19
Checking the power unit 22
Spare parts 23

WARNING: Before installing and/or operating this device, this manual must be understood by the qualified electrical maintenance person who is familiar with this type of equipment and the hazards involved.
Failure to observe this precaution could result in bodily injury.

WARNING: Electronic devices are in principle not fàil-safe. It is the responsibility of the user to ensure, that in the case of a failure of this device, the drive is brought to a safe condition. Especially on drives for use with personnel transportation, electronic independent safety circuits must be provided.

WARNING: Electronic convertors cause disturbances to the supply network.
Because they are dependent on the supply network (impedance) the basic version of the INVERTRON REO does not include any radio interference- or harmonic filters, to fulfil the limits in the recommendations.

Features

The energy feedback unit INVERTRON REO is designed as an option for the medium-power range voltage source frequency converters of the style INVERTRON VTI, VCI, VGI.

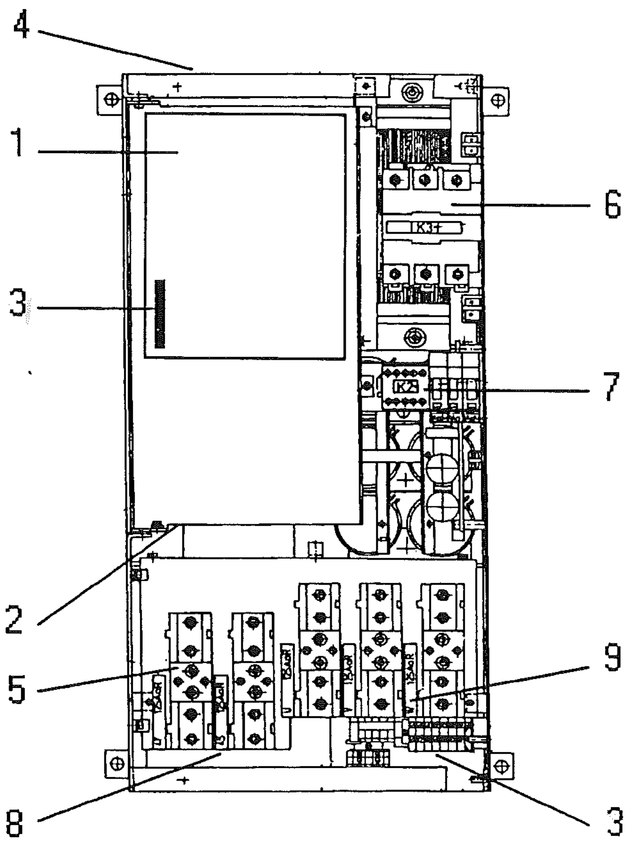
In combination with a REO the inverter can be used for all four drive quadrants; that means the load can be, in both senses of direction, either motoring (driving) or regenerative (braking).

When working with a regenerative load, the intermediate circuit voltage increases and the six pulse thyristor bridge leads the current back to the AC-line. To reset the thyristors and to shut down in case of overcurrent, two transistors are used. The efficiency in case of regenerative load depends on the motor used, and the inverter used and the REO. The maximum efficiency of the REO is about 97 %.

Characteristics:

- High reliability due to SMD and a proven protection concept.
- AC-line voltage 400 or 460 V
- Protections against line overvoltage peaks
- Integrated fuses to protect the converter against short circuits and earth faults
- Collective fault indication (relay output), LED display for different operating states.
- High dynamic, small mechanical load fluctuation, and no commutation failures caused by load referred regulation in regenerative operation.
- Instantaneous electronic trip (IET) in case of:
  - Overload
  - Overcurrent
  - Low voltage
  - Fault in the DC-bus
  - Overtemperature
  - Fault on regulator supply
- Connector for the Tester Part number: 836.59.00:
- REO Part number: 890.10.00

Construction



1 Regulator card RRA

2 Interface card RIA (rear side)

3 Signal and control terminals

4 Heatsink and power unit

5 Semiconductor fuses

6 Line contactor

7 Auxiliary contactor

8 DC-bus connections

9 Line input-connections

Fig. 1-1: Construction of the energy feedback unit REO

RIA interface card

see block diagram figure 1-2, Page 5

Block	Function
(1)	Line voltage feedback
(2,3)	Bus voltage feedback
(4)	Current feedback
(5,6,7)	Voltage supplies
(8,9)	Transistor driver
(10)	Thyristor-gate-control

Regulator-card RRA

see block diagram Figure 1-2, Page 5

Block	Function

(11) Summer, filter and **Uac-generator**

(12) The **comparator block** gives the positions of the zero-axis crossings and the AC-line voltage polarity

(13) The **firing distributor** chooses the right thyristors according to the phase position.

(14) The **pulse shaper** chops the control signal for the gate control (10) and generates the transistor driver control signal (T on).

(15) The **ALPHA-regulator** calculates the modulation angle for the modulator out of the difference from (ALPHA) Udc, Uac and delta U.

(16) The **modulator** generates a line synchronous ramp and makes a comparison to the ALPHA-signal. The output signal TRANS defines the duration and the switching point of the transistors and thyristors.

(17) The **HBUS-comparator** responds if Udc - Uac - delta U > 0 and activates the REO (that means: without HBUS-signal no power feedback).

(18) The **undervoltage detection** covers only the line voltage

(19) The **current limiting** and the **short circuit detection** monitor the current feedback and switch off the transistors if a limit value is exceeded.

(20) The **power limiter** consists of:
(21) an integrator and a comparator.
The integrator adds the difference of the current feed-back IT_2 to a current reference (Up). If the result is positive, it starts to decrease (initial value 8 V). When - 6,5 V is reached, the comparator switches to OVL (overload) and disables the regulator.

(22) **Voltage regulator**
for regulator supply voltage ± 13,0 V

(23) In case of power-up and coarse undervoltage at the regulator supply the **RESET generator** resets all stored faults. The PS 2 signal indicates that the regulator supply is ok. The PS 1 signal indicates that the RIA print supply is ok.

(24) **RESET-input** - potential free, DC 24 V with opto coupling

(25) **RUN-input** - potential free, DC 24 V with opto coupling

(26) **24 V control voltage output** - short circuit proved, to be used for RUN and RESET inputs only.

(27) **Logic and indication block.** Here all logic signals are combined. It controls the regulator enabling the fault handling and the sequencing. Its outputs are:

MC: switch on main contactor
OPER: regulator enable
READY: contact output "unit o.k.", see chapter 5

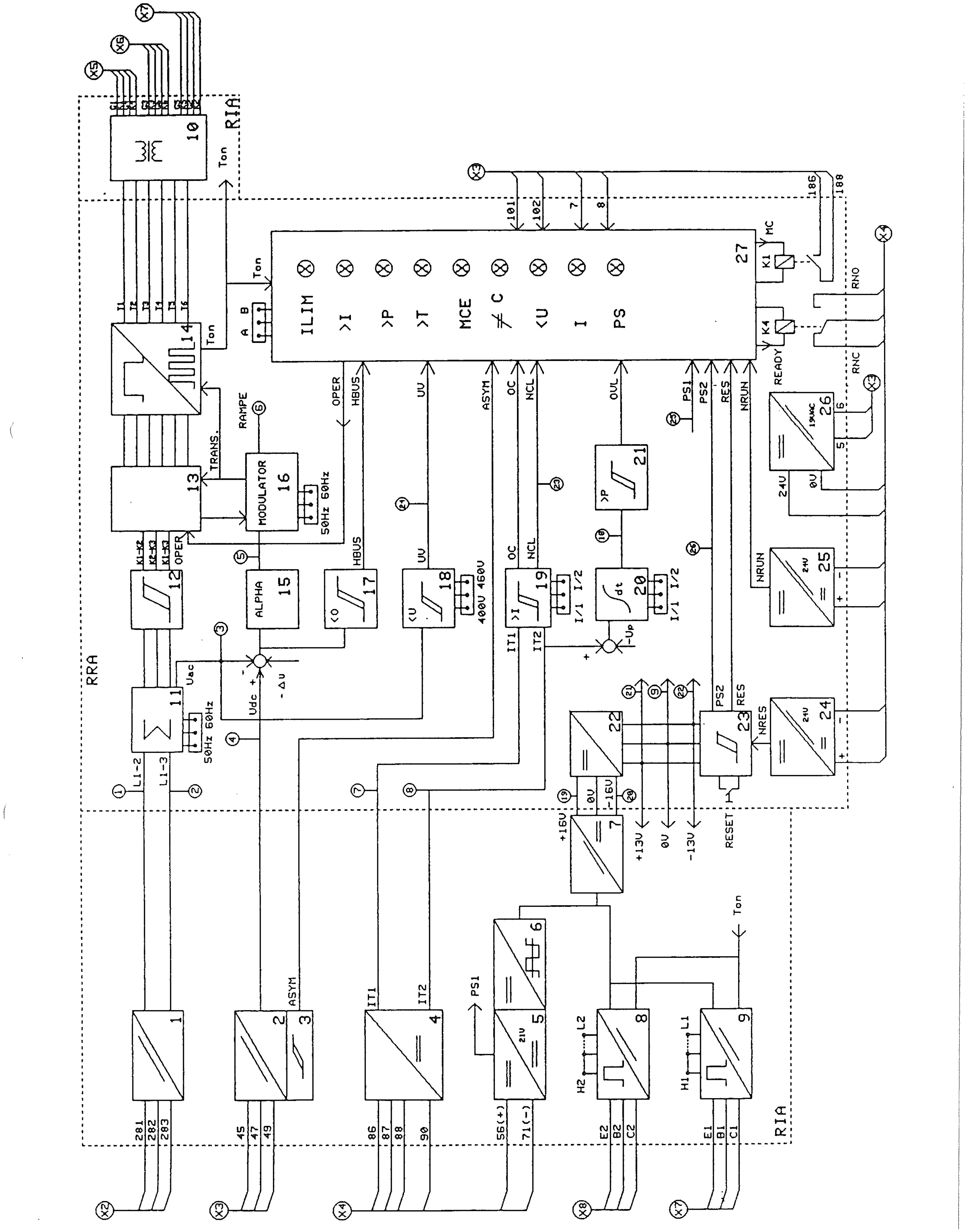


Figure 1-2: Block diagram RRA and RIA cards

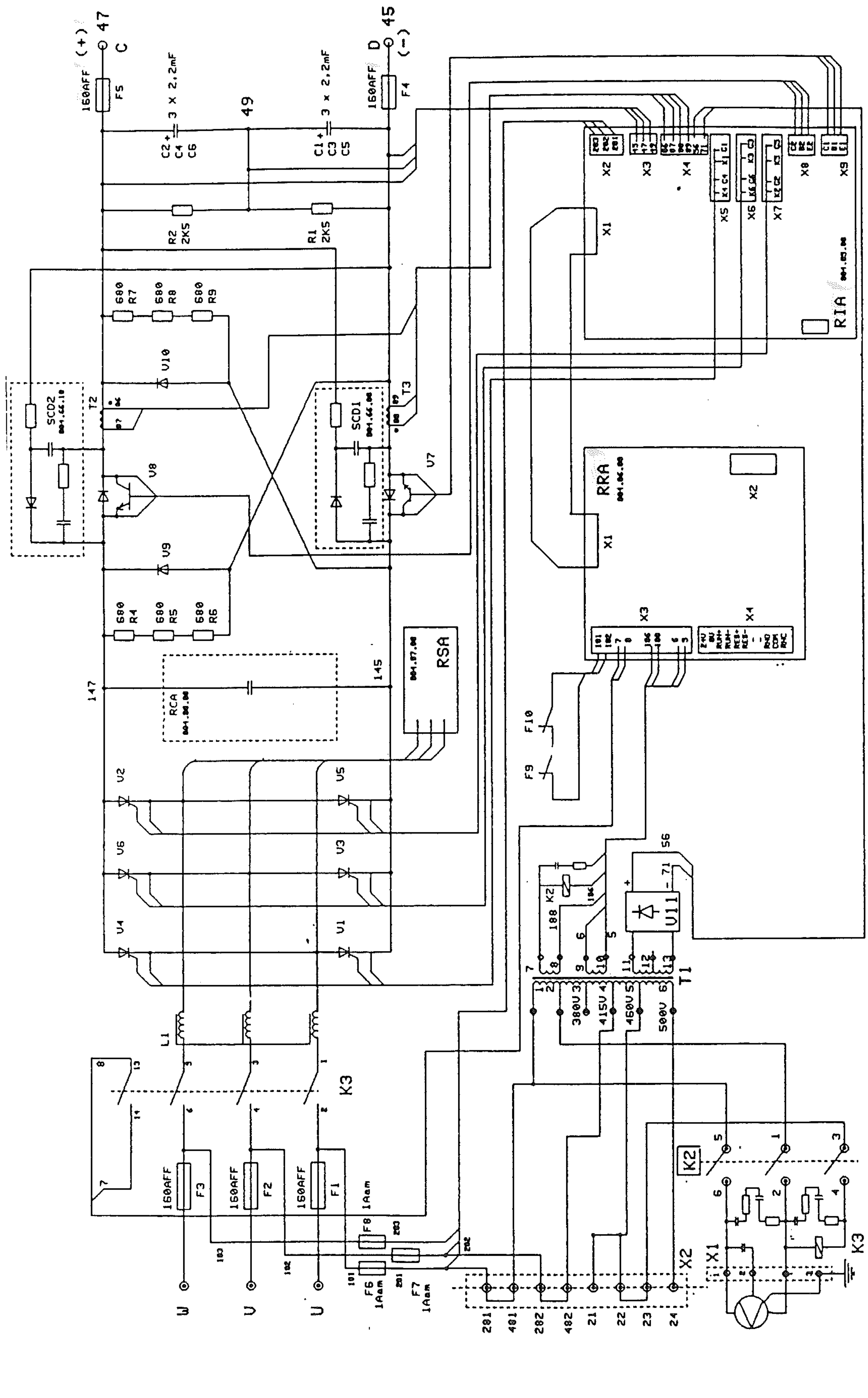


Figure 1-3: Block diagram of the power stack

Power stack
See Figure 1-3, Page 6

Construction

The three phase line voltage is connected to the input bus-bars U,V,W. Via the line input fuses F1, F2, F3 the line voltage is also connected to the control transformer protected with fuses F6, F7, F8, which supplies the control-voltage for the power supply to the bridge rectifier V11.

The line choke limits the current rise and allows that drive to be used on any transformer up to the maximum short circuit current of the fuses (23 kA minimum, 100 kA maximum).
The RSA print contains elements for the line input overvoltage protection.

The rectified, filtered DC voltage of the convertor is connected to the transistor-diode module via terminals 45 and 47 and the fuses F4, F5.

The fully controlled, forced commutated, six pulse-current converter bridge converts the DC-voltage to a three phase line voltage.

The power modules V7, V8, combined with SCD cards form an exchangeable spare parts unit per path. Two current transformers T2 and T3 provide the current-feedback to the interface card.

Function

When the RUN input is activated and the bus voltage is about 45 V higher than the peak value of the line input voltage, the current is regenerated via the power transistors V7, V8 and the thyristors V1 - V6.
If the difference between bus- and peak line voltage is lower than 45 V, the regulator switches to standby, the transistors are switched off by the base drivers of the RIA print and the current is extinguished by the diodes V9, V10.

Control
See Figure 5-1,Page 17

RUN, switch on

The REO is ready for operation if line voltage is connected to the terminals U,V,W and the green LED "PS" (power supply) is on. The regulator is disabled until the control voltage is connected to the RUN input.
In subsequence the main contactor K3 is switched on via auxiliary contactor K2.

RESET, fault reset

A stored fault (e.g. C, MCE, > P, < U, > I) can be reset by connecting the control voltage to the RES-input or by pushing the RESET button on the RRA print.

RESET is also a lamp test for all the red and yellow LED's.
During running without error a RESET has no affect to the REO.

The **READY output** is a potential free relay contact.

If the supply voltage is built up and no fault has occurred, the contact RNO-COM closes and RNC-COM opens. When a fault occurs the relay drops out again.

Table 1-1: Protection concept

Indication LED	Function	Block No.	Protection measure
ILIM	Current limit	19	Current pulse is switched off, no regulator disabling
> I	Short circuit or Overcurrent > 300 A	19	Current pulse is switched off, Regulator disabled
> P	Overload during longer period	20, 21	
> T	Overtemperature at heatsink or ambient air	F 9 F10	
≠ C	Asymmetry on DC-Bus	3 (RIA)	
MCE	Main contactor not picked up	27	Current pulse is switched off. Regulator disabled. with Jumper A: Enabled after "RESET" with Jumper B: Autoreset
< U	Line undervoltage or phase loss	11, 18	Current pulse is switched off. Regulator disabled as long as the Undervoltage is present (Autoreset)
PS	Supply o.k.	5, 23	In case of fault current pulse is switched off Regulator disabled as long as the error is present (Autoreset)

Diagnostic device (Tester)

The universal Tester (stock no.: 836.59.00) that is used for the VTI inverters can also be used for the REO.
It is connected to the regulator print RRA, via connector X2 and allows testing of some regulator signals during start-up and trouble shooting.

The switch positions of the different signals are circled numbers in the regulator block diagram. See figure 1-3, Page 5

NOTE: The displayed numerical values of the tester are mean values. The bar display shows the variation range of the signal.

Table 1-2: Signals available on the Tester / Diagnostic device

Switch-Position	Signal Name	Voltage Range (V)	Description Indication
1	L1-2	0..5 V AC	Line voltage feedback 0.58 x U / 100 at 50 Hz, U / 200 at 60 Hz
2	L1-3	0..5 V AC	Line voltage feedback (as L1-2)
3	UAC	0..8 V	Line voltage signal 400 V => 5.4 V
4	UDC	0..8 V	DC-Bus voltage 100 V => 1.0 V
5	ALPHA	0..9 V	Pulse width of the output current 0..50 degree => 0..8V
6	RAMPE	0..7.5V	Line synchronous ramp voltage
7	IT1	0..6 V	Current through V7 100 A => 2.0 V
8	IT2	0..6 V	Current through V8 100 A => 2.0 V
9	GND	0 V	Regulator zero
10	UINT	- 6.5..9 V	Overload integrator (OVL = overload) without overload UINT > 8.8 V OVL-trip UINT <= -6.5 V
11-18			not used
19	+16 V	+15.5 +16.5V	Unregulated supply
20	- 16 V	- 15.5. -16.5V	Unregulated supply
21	+13 V	13.0 V	Regulated positive supply
22	- 13 V	-13.0 V	Regulated negative supply
23	NCL	0/-13 V	current limit limit =-13 V
24	UV	0/-13 V	undervoltage = 0 V
25	PS1	0/-13 V	supply 1 o.k. ok = 0 V (Chopper regulator on RIA card)
26	PS2	0/-13 V	supply 2 o.k. ok = 0 V (regulated regulator voltage)

Table 2-1: Electrical Data

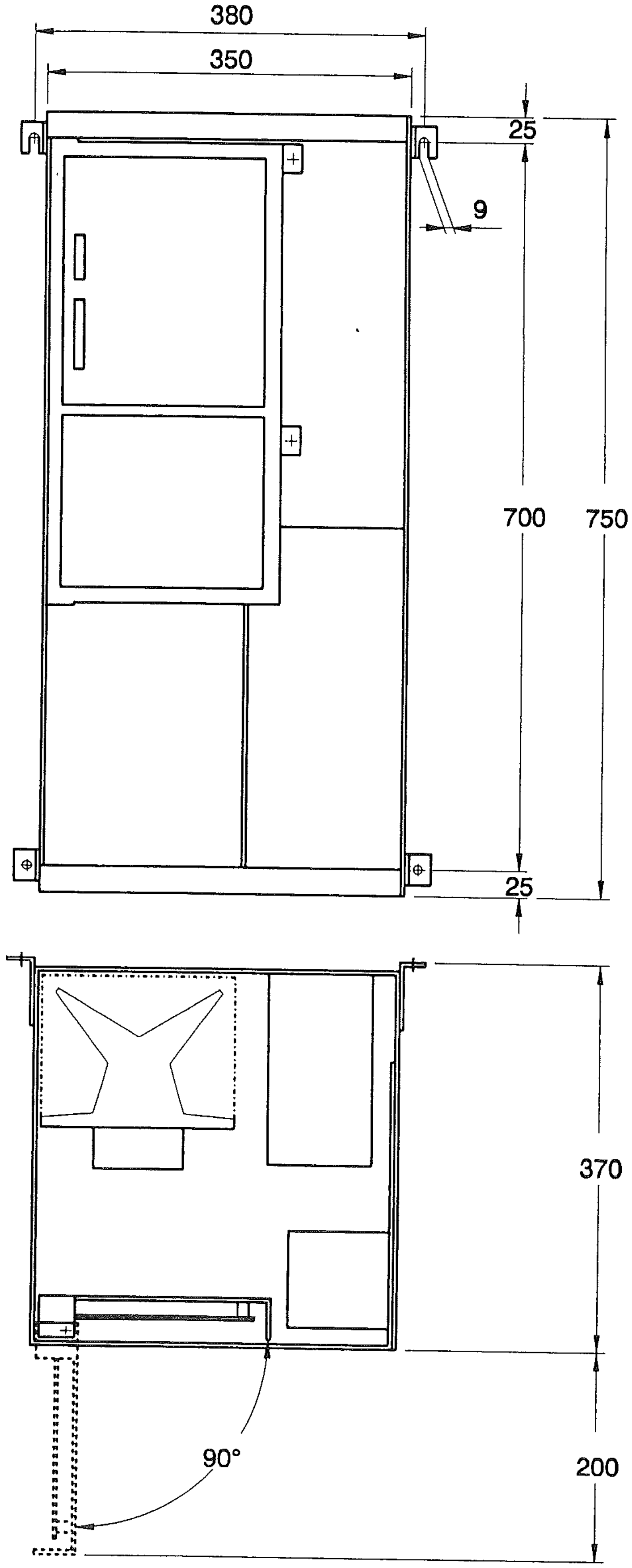
Line Input	Three phase line input voltage	400 / 460 V
	Line voltage tolerance	± 10 %
	Line frequency	50 / 60 ± 2 Hz
	Maximum permissable short circuit current	100 kA
	Minimum permissable short circuit current	23 kA
	Line current	106/85 A
	Line fuses	super quick (aR) 160 A
	Supply for control transformer	400/460 V, 50/60 Hz
	Regulator fuses	1 A aM
Intermediate ckt (DC-Bus) Stadio intermedio DC	Intermediate ckt voltage	540-660 V / 620-760 V
		125 / 100 A
	Intermediate ckt current mean value	100 / 80 A
	Load cycle at 460 V 60 Hz e. g. on centrifuges	50% duty: 5 min 100 A 5 min 0 A
	Discharge time to U_{DC} < 50 V	< 60 s
	Fuses	super quick (aR) 160 A
	Minimum inverter power* I/1 1)	45 kW
	with add. line choke and I/2	22 kW
Regulator- In- and Outputs	Control transformer primary voltage (internally selectable)	AC 400/460 V
	Control voltage (0,24 V auf RRA)	DC 24 V, 20 mA
	Regulator voltage supply	DC ± 13 V ± 10 mV
	Control input: Control voltage Current consumption per input	DC 24 V ± 15 % 10 mA
	Control outputs: Relay contacts "RNC" and "RNO"	250 V, 8A, AC 1
Monitoring Functions LED indication	**LED lights at:** Overcurrent, short circuit (Peak value) > I	Trip level: 300 A
	Overload (Mean value) > P	1) I/1 > 100 A I/2 > 50 A
	Overtemperature > T	Heatsink 85 °C Regulator environment: 60 °C
	Main contactor monitor error MCE	
	Asymmetrie at dc-bus = C	ca 160 V
	Undervoltage at line input or phase missing < U	< 230/260 V
	Regulator supply ok PS	> 11 V
	REO active (in regener. mode) I	
	Current limit ILIM	1) I/1: 275 A I/2: 135 A

1) On Bus systems total sum of the inverter power! See also page 14 second paragraph.

Table 2-2: Ambient conditions

Temperature	- Operation: 0 °C ... +55 °C For temperatures higher than 45°C up to max. 55° C the nominal continuous current I_{nom} must be derated by1.5 % per degree. - Storage : -25 °C ... +55 °C - Transportation: -25 °C . +70 °C (+70 during max. 24 hours)
Ambient relative humidity	max. 50 % at 40 °C unlimited max. 90 % at 20 °C during max. 30 days / year 75 % average (class F, DIN 40 040) *NOTE*: Condensation not allowed!
Air pollution	The ambient air may contain some dry dust but must not contain excessive dirt, chemical fumes, oil vapour etc.
Installation altitude	max. 1000 m above sea level. At higher altitude the output power is reduced! Please ask Reliance Electric.
Degree of protection	IP00

Dimensions



Weight : 80 kg

Fig. 2-1: Dimensions

Calculating the maximum breaking power

The maximum breaking power P_B of a V* I Inverter - REO combination is determined by the unit with the lowest power.

Maximum breaking power of the V*I Inverter P_1 [W]:

$$\boxed{P_1 = U_n \cdot I_{max} \cdot \cos phi \cdot \sqrt{3} \cdot \eta}$$

U_n [V]:	Motor nominal voltage
I_{max} [A]:	Maximum output current
cos phi:	Power factor of the motor (0,85 ... 0,95)
η:	Efficency of the motor (0,90 ... 0,94)

- Maximum breaking power of the REO P_2 [W]:

$$\boxed{P_2 = P_R / \eta}$$

P_R [W]:	Regenerating power of the REO from DC-Bus: (at I/1 P_R = 55 kW at I/2 with add. line choke P_R = 27 kW)
η:	efficency of the motor (0,90 ... 0,94)

- Maximum braking power P_B of the combination motor - V*I Inverter - REO:

$$\boxed{P_B = \text{lower value of } P_1 \text{ and } P_2}$$

NOTE: AC-line voltage dips (e.g. commutation dips) can disturb the function of the REO. Under special conditions the power is not fully available.

Calculating the minimum breaking time t_B [s]

a) international system (SI):

$$\boxed{t_B = \frac{J \cdot \text{delta } n \cdot n}{91 \cdot P_B}}$$

J [kg m^2]: Drive systems moment of inertia referred to the motor shaft

a) imperial system (FPS):

$$\boxed{t_B = \frac{WK^2 \cdot \text{delta } n \cdot n}{2160 \cdot P_B}}$$

WK^2 [lb ft^2]: Drive systems flywheel effect referred to the motor shaft

n [rpm]:	Maximum speed before braking
delta n [rpm]:	Speed difference; before and after braking

If the moment of inertia or flywheel effect is unknown, the brake time can be determined by the acceleration time (see instruction manual of the inverter).
This method is valid as long as the REO is not the limiting factor (see chapter 7 trouble shooting).

Operation with multiple REO's

Simultaneous operation of multiple REO's on the same line increases the minimum required short circuit current I_k':

$$I_k' = 23 \text{ kA} . n$$

n = number of REO's working at the same time on the same line

Using the additional line choke (diagram 5.1) and half power only (I/2) the required short circuit current I_k' is:

$$I_k' => 16 \text{ kA} . n$$

Operation with half of the maximum power

For the REO operation with low power inverters (22-37 kW) the REO power can be halved by using the two jumpers for I/2.
In this case it is recommended to install an additional line choke (stock no.: 252.40.05) to improve the current form of the REO. The choke also reduces the line harmonics. The installation of additional chokes has to confirm with diagram 5.1. Please also take care of correct wiring and fusing of the control transformer.

Minimum converter power

The DC-bus connected to the REO (system bus or single inverter) shall have a minimum size.

$$C_{BUS} => 3300\ \mu F$$

That means, as a single RELIANCE INVERTRON V*I Inverter, from 22 kW up can be connected. From 22 to 37 kW an additional line choke should be installed.

In common-bus systems the single inverter power can be lower, but note that the charging device has to charge also the REO DC-bus (C_{BUS} (REO) = 3300 μF)

Adapting the control transformer

Table 4-1

		Jumper
Line voltage:	380 V ... 430 V	281-481 and 282-482
	430 V ... 460 V	281-481 and 282-21
Line frequency:	50 Hz 60 Hz	22-23 23-24

Separate supply for the control transformer

Remove jumpers 281-481 and 282-482 or 282-21.

Table 4-2

	Supply with:	Connect to Terminals
Voltage:	380 V .. 430 V: 430 V .. 460 V:	481-482 481-21

In case of separate regulator supply, the line U,V,W has to be connected only if the regulator supply is already switched on. Up to that point the REO indicates undervoltage < U and the output contact is switched to "NOT READY".
In addition the control transformer has to be fused with 1 A (see connection-diagram 5.1)

Adapting the regulator functions

Table 4-3

		Insert Jumper blue	 red
Line frequency:	50 Hz/	50 Hz	
	60 Hz	60 Hz	
Line voltage:	380 V ... 430 V	400 V	
	430 V ... 460 V	460 V	
Current limit:	for 55 kW		I/1
	for 27 kW		I/2 1)

1) with red jumper and additional line choke 252.40.05 connected according to diagram 5.1.

Storing of the main contactor error (MCE)

On lines with frequent and deep undervoltage periods the main contactor may drop out and lead to a MCE trip. If the line voltage is all right again, the REO stays disabled (MCE).
If this disturbs the operation, the jumper B (switch on and try again) can be used instead of jumper A (store).

Normal store	jumper A
If problems with MCE	jumper B

Assembly

When installing the REO in cabinets please observe the same rules as for the inverter (see instruction manual).

Connection

Line and intermediate circuit connection

To avoid oscillations between the capacitor units of the REO and the V*I Inverter the two leads to terminals 45 and 47 should be bundled and kept as short as possible (max. 2.5 m).
Cable cross sections for the line connection and the intermediate circuit should be chosen for the maximum effective current as follows:

Regulator Adapting	Line connection Current	Cross section	Intermediate ckt Current	Cross section
I/1	106 A	50 mm2	125 A	50 mm2
I/2	53 A	25 mm2	62 A	25 mm2

Signal wire connections

The control connection to the terminal block X4 of RRA card have to be installed with shielded wire. Observe the standard rules for the connection of signal wires and suppressor circuits for contactor coils.

Connection table to connection plan See Figure 5-1, Page 17

Connection	Designation	Function	Location
Control inputs	RUN+ RUN- RES+ RES-	RUN Command, DC 24 V RESET Command, DC 24 V	RRA Terminals X4 RRA Terminals X4
Control outputs	RNO - COM RNC - COM	READY Output, N. O. READY Output, N. C.	RRA terminals X4 RRA terminals X4
Line connect.	U V W PE	Line voltage 3 x 380-415 V resp. 3 x 440-460 V Protection earth connector PE	Bus-bars bottom right Case bottom right
	481 482	supply for regulator transformer see Chapter 2, 3 and 4,	Terminal block bottom right
Intermediate ckt	45 47	for the Intermediate ckt connect. of the inverter see below	Bus-bars bottom left
Control voltage	24 V, 0 V	DC 24 V for the control inputs	RRA terminals X4
Diagnostic (Tester)	X2	Measuring facilities for internal regulator signals	RRA terminals X2 right

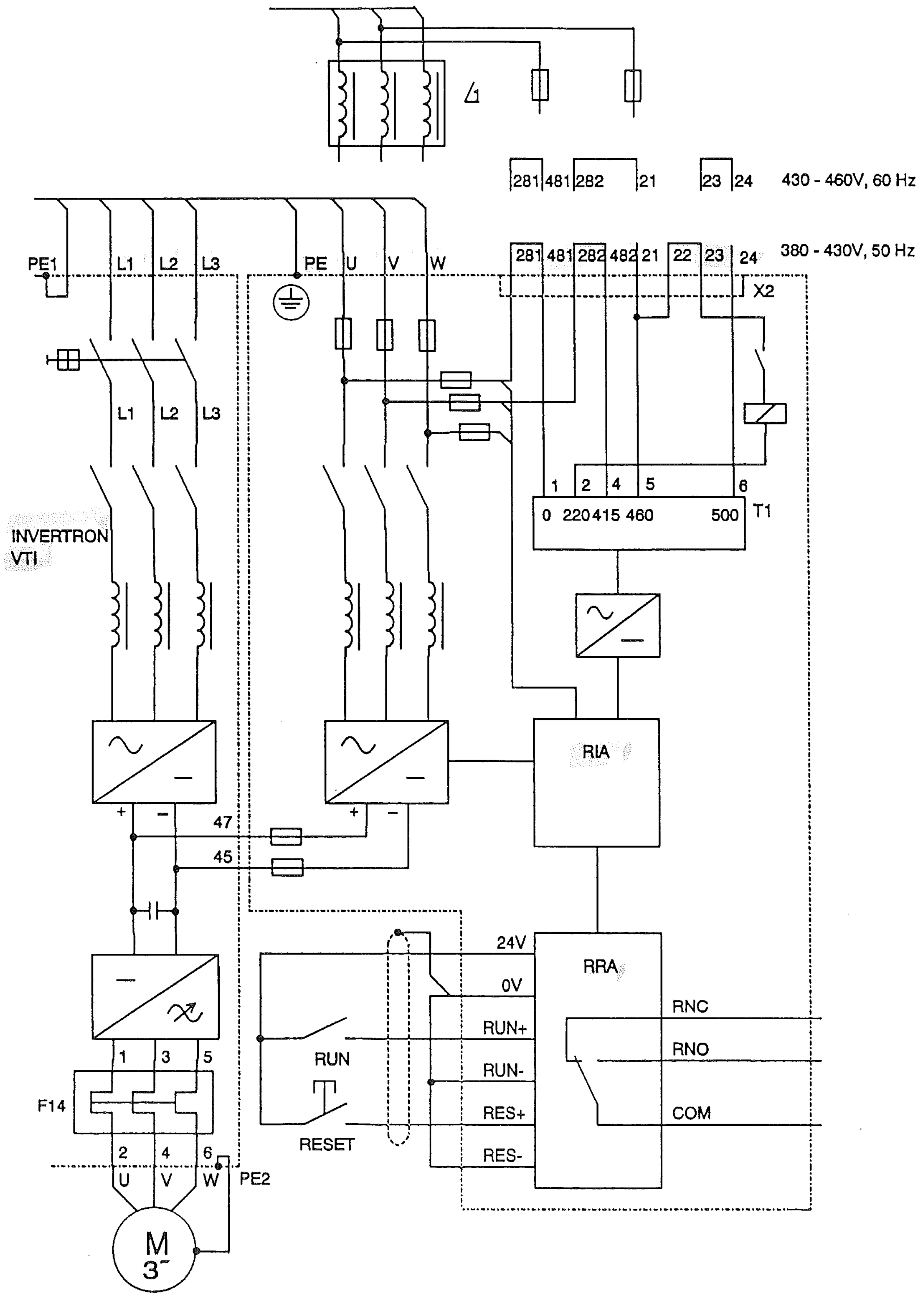


Figure 5-1: Connection diagram

⚠1 additional 3-phase line choke part no. 252.40.05 for inverters 22 - 37 kW

Safety Precautions

WARNING:
This equipment should only be installed, adjusted and serviced by trained and qualified electrical personnel familiar with the drive functions and operation and the hazards involved. wrong handling may cause damage to the machine or injury to personel.

Whenever work is done on the unit the input ac-power must be disconnected and the dc-bus voltage at terminals 45-47 checked with a voltmeter. Verify that this voltage has been dropped below 50 V (approx. 2 minutes).

Static sensitive PC-boards. Handle without touching components, connectors or leads.

General pre-operation checks with power off

The procedures of the previous chapters 4 and 5 must be completed and checked before the drive is ready for start-up. It is also recommended, to become familiar with the functioning of the device by studying chapters 1 and 2.
As the convertors are delivered fully tested, problems during start-up are caused in most cases by faults outside the controller (see chapter 7, trouble shooting).

For recommended measuring devices see chapter 7

- Check of all jumpers according to Tables 4-1 to 4-3, chapter 4
- Visual check of REO, V*I Inverter and motor for mechanical damage.
- Check of signal wire connections and transient suppression of relay coils.
- Check of all external connections according to interconnecting diagram (cross sections, wiring earth fault and grounding).
- Preparations on the V*I Inverter according to its instruction manual.

General checks with mains voltage applied

- Check regulator supply

  After applying line voltage the LED-indication must be lit.

Start-Up of the V*I Inverter
see the valid instruction manual

- Program the V*I Inverter for "linear ramp"
- Adjust the deceleration time to a value just above the minimum braking time (see chapter 3, application notes)

Start-up of the REO

- Connect the diagnostic unit Tester (if available) to connector X2 on RRA print
- Switch on "line voltage" (phase sequence unimportant); the LED "PS" is lighted
- Measure the line voltage at REO input connections U, V, W or line voltage feedback Uac (tester pos. 3)

  $$U_{AC} = \frac{1{,}35 \text{ x line voltage}}{100}$$

- Switch on the inverter and adjust to its minimum speed
- Give the START command
- Measure the intermediate circuit voltage feedback (tester pos. 4 or connections 45,47)

  $$UDC = \frac{1{,}41 \text{ .x line voltage}}{100}$$

- Run an operation cycle (accelerate, brake)

  Verify that the yellow LED ILIM is not lit at any time and the REO and inverter are operating without fault. Otherwise the REO may be undersized or the braking time too short (see chapter 7 trouble shooting)

Test Instruments

The following meters or their equivalent are recommended:
An analog multimeter having a sensitivity of minimum 100 kohm/Volt or a digital multimeter with a 10 megohm input impedance on all ranges (FLUKE) or the RELIANCE ELECTRIC diagnostic unit (TESTER
For trouble shooting inside the controller an electronic short circuit tester and an oscilloscope will be required.

> *NOTE*:
> The scope must not be **grounded** and should be connected to mains by means of an isolation transformer. The scope impedance must be min. 8 Mohm (probe 1:10).
> This is required for all measuring instruments with mains supply.
> The voltages measurements on the power unit must be differential.
> For checking the controller, care must be taken, that the housing of the scope is connected to zero potential (Pin GND, coordinate AR146 on the RRA-card).
> **Never connect the scope while the drive is switched on.**

Cooling fan check

Normally the controllers will work without any maintenance. One exception are the cooling fans on power units and control cubicles. Their bearings should be visually checked from time to time, because the lifetime is limited. (they are designed to operate in continuous service for about 20 000 hours.) It is recommended to replace the fans (or bearings if possible) before the end of the lifetime to prevent breakdowns on the machine.

Trouble Shooting

As the Units are delivered fully tested, problems during start-up are caused in most cases by faults outside the controller such as - Engineering errors, wrong connections, operating faults or wrong regulator adaptations.

Trouble shooting steps

. Determine operation condition where the fault occurs
* Determine fault symptom

With this information consult the following Tables of trouble shooting suggestions and locate the fault with the aid of the connection diagram.
If this procedure should not be successful, trouble shooting must be continued systematically in or against the direction of signal flow.

Table 7-1: Faults and possible causes at the REO

· Operation condition * Symptom	Possible Cause	Required Test	Remarks to trouble shooting
· Unit switched on · no RUN-Command * LED PS (gn) remains dark	No supply voltage	- Check line voltage U,V,W and fuses F1, F2, F6, F7 - Check connection of control transformer	
	Undervoltage at RIA card	- PS1 (Tester Pos. 25) is "L" (- 13 V)	The different regulator voltages are connected to the Tester: Pos. 21 + 13,0 V reg. Pos. 22 - 13,0 V reg. Pos. 19 + 16V unreg. Pos. 20 - 16V unreg.
	Undervoltage at RRA card	- PS2 (Tester Pos. 26) is "L" (- 13 V)	
· Unit switched on · no RUN-Command * One or both LED's (gn) remain dark	Inverter defective	- Tester Pos. 19 & 20 shows no voltage	Replace RIA card
	Transistor module defective	- Disconn. X8 and X9 If the appropriate LED lights up again the module is defective, if not, the transistor driver is defective	UBE muss between - 4 V and - 5 V liegen If the LED PS remains dark, see above!
. Unit switched on * LED = C lit	Asymmetric DC-Bus	- Check capacitors 45-49 and 49-47 - Check feedback 45, 47 and 49 - Check resistors betw. 47-49 and 45-47	Remove connect. 49 between capacitors and symmetrize res. Deviation between the resistors is 10 % maximum
. Unit switched on * LED < U lit	Line undervoltage	- Check line voltage U,V,W and compare with UAC (Tester Pos. 3)	$UAC = \frac{1,35 \times UN}{100}$
	Line voltage or line frequency wrong programmed Phase W missing	- Check fuses F3 & F8 connections W, 183 and 283	Compare line voltage and UAC (Tester Pos. 3)

Table 7-1: Faults and possible causes at the REO (continued)

· Operation Condition * Symptom	Possible Cause	Required Test	Remarks to trouble shooting
· Unit switched on * all LED's lit, except >I possibly	RESET-command present.	Measure the voltage at RES-Input	
· Unit switched on ° RUN-Command	(Main Contactor Error) Main contactor does not pick up	After RESET again MCE.	Check main contactor K3, contactor K2, auxiliary contacts and RRA connector X5
* LED MCE lit	Main contactor drops due to line undervolt.	after RESET normal operation again	Insert jumper AB in position B
·Unit switched on . RUN-Command * LED > I lit	Short circuit	Check fuses, thyristors and diodes for short circuit, check current feedbacks IT1 and IT2 (Tester Pos. 7 u 8)	IT1 = IT2 < 2,0 V
· Unit switched on . RUN-Command * LED > T lit	Case temperature exceeded	Check trip of thermal switch F9 , F10, fan and cabinet filter	Check ambient temperature (see Chapter 2)
· Unit switched on . RUN-Command * LED > P lit	Continuous overload (Current limit)	IT2 (Tester Pos. 8) should exceed 2 V not longer than 1 min	Reduce the load, adjust for less steeper ramp see Chapter3 Application notes

Table 7-2: Fault trips and possible causes at the V*I Inverter

. Operation condition * Symptom	Possible cause	Required Test	Remarks to trouble shooting
* LED > U or > I lit	REO does not or insufficient regene-rate (Overload)	- Eliminate overload - Check control (RUN) and current limit (ILIM)	see Chapter 3. Application notes
* LED < C lit	Bus-short circuit or conn. 45 and 47 between REO and inverter inter-changed	- Remove short circuit in REO or inverter (45,47,49) - Check connections 45, 47	

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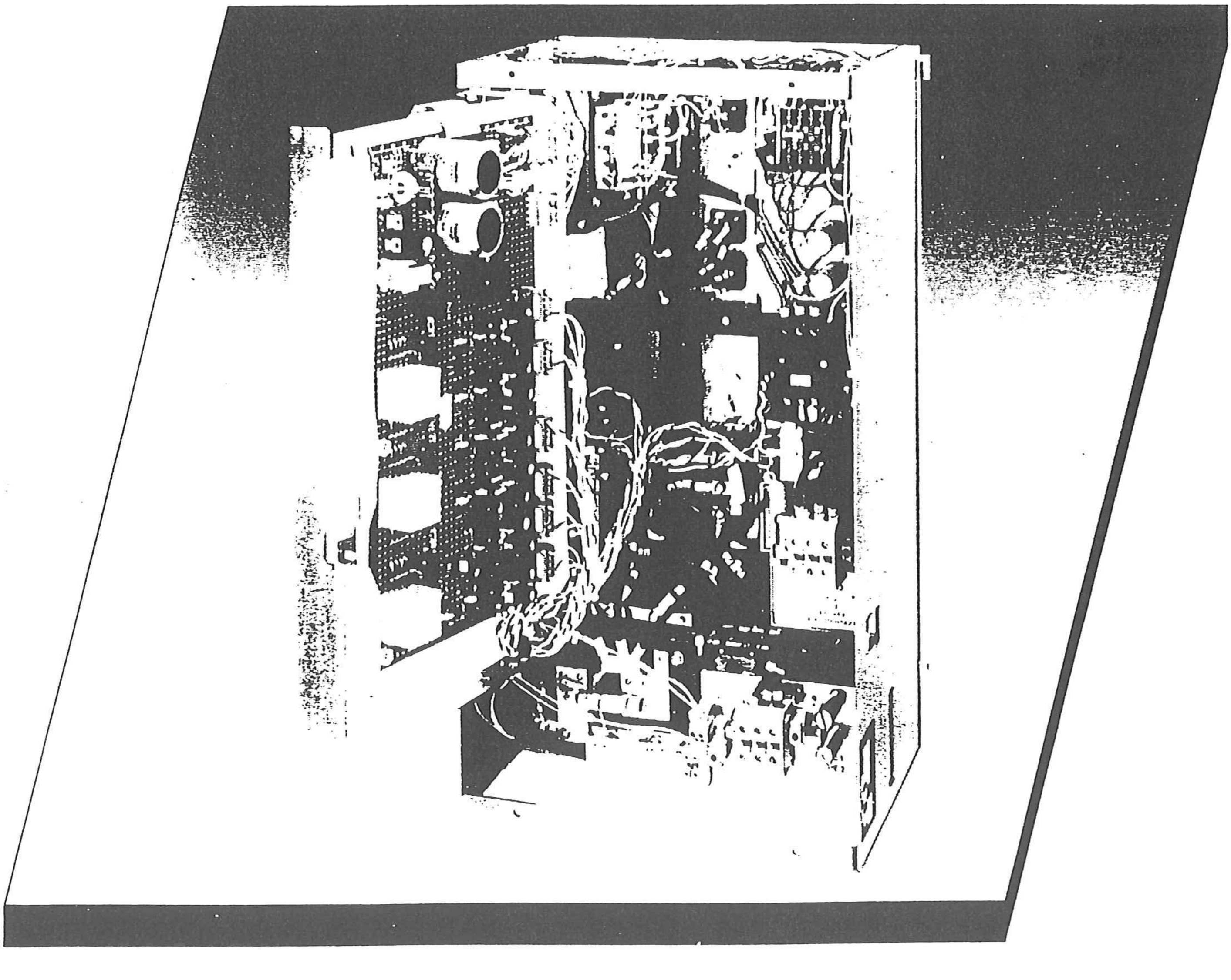
RELIANCE ELECTRIC

Printed in Switzerland

INVERTRON AC 400/500 V
V*I Power Unit

- AC to DC
- DC filter
- DC Brake Unit
- DC to AC

Instruction manual
Betriebsanleitung
Instructions de service
Istruzioni di servizio
Manual de instrucciones



RELIANCE ELECTRIC

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This instruction manual provides a functional description of the Power Units for the INVERTRON PWM-Converters with circuit diagram and Specifications (Chapter. 2), Installation Guide-lines (Chapter 3) general trouble shooting suggestions and spare parts lists (Chapter 4).
For Start-up instructions please refer to the regulator manual.

WARNING: Before installing and/or operating this device, this manual must be understood by the qualified electrical maintenance person who is familiar with this type of equipment and the hazards involved.
Failure to observe this precaution could result in bodily injury.

WARNING: Electronic devices are in principle not fail-safe. It is the responsibility of the user to ensure, that in the case of a failure of this device, the drive is brought to a safe condition. Especially on drives for use with personnel transportation, electronic independent safety circuits must be provided.

WARNING: Electronic convertors cause disturbances to the supply network. The basic version of the INVERTRON does not include any radio interference- or harmonic filters, to fulfil the limits in the recommendations, because they are dependent on the supply network (impedance).

WARNING: Earth fault detection devices must not be used on this convertor as sole protection measure against unintentional touching. The DC-component in the earth fault current may inhibit the correct function of the fault detector.

SPECIFICATIONS

Power Input Data

- Line input voltage threephase, with protection earth
  for the two types (380/415 V).. 400 V ±15%
  and 500 V .... 500 V ±10%
- Line frequency standard..50 Hz, ± 4 %
- Line voltage tolerance.. ± 10 %
- Maximum permissible short circuit current (with fuses built in).................................... 100 kA
  For external line fuses the maximum ratings as stated below must be provided.
- Line input contactor and choke built-in.
- Line input current .... = Motor current x 1.1
- Supply of control transformer .... AC 380/415 V or 460 V or 500 V / 600 VA

Power Output Data

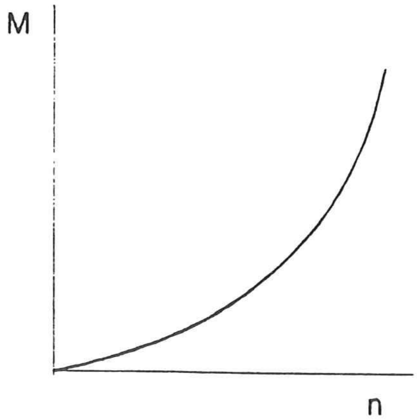
- Output frequency ....0 to 240 Hz
- Modulation .... sine wave pulse width modulation PWM
- Motor protection ....by overcurrent relay

Table 2-1: Line Input, DC-Bus and Motor Connections

Unit Size	V*I Type Inom. at 400V	V*I Type Inom. at 500V	Line Input Fuses F1, F2, F3 *	Cross Section [mm²] Line Input	Cross Section [mm²] Motor Leads	Line Input L1-L3 and Motor Conn. U, V, W Terminal	or Bolt	PE	DC-Bus 45/47
1	021		gL 32 A*	10	16	SAK16		16	M5
		024	gL 32 A*	10	16	SAK16		16	M5
	032		gL 40 A*	16	16	SAK16		16	M5
2	040		gL 63 A*	25	35	SAK35		16	M5
	043		gL 63 A*	25	35	SAK35		16	M5
		046	gL 63 A*	25	35	SAK35		16	M5
	060		gL 80 A*	35	35	SAK35		16	M5
	070		gL 80 A*	35	35	SAK35		16	M5
	088		gL 125 A*	50	70	SAK70		16	M5
3		082	gL 125 A*	50	70		M8	M8	M6
	111		gL 160 A*	70	70		M8	M8	M6
	143		gL 200 A*	150	95		M8	M8	M6
4		164	gL 250 A*	150	150		M12	M12	M8
	216		gL 250 A*	150	150		M12	M12	M8
	240		gL 315 A*	150	150		M12	M12	M8
5	305/ 380 450		aR 800A**	300	300	Bus bar hole 13 diam.	M12	M12	M8

* external fuse type: VDE 0636/gL or IEC 269/gG or BS88 or equivalent (See spare parts list)
** built-in SCR protecting fuse

Table 2-2: **INVERTRON V*I Selection for the Fan and Pump Application** (without overload for 400V version)

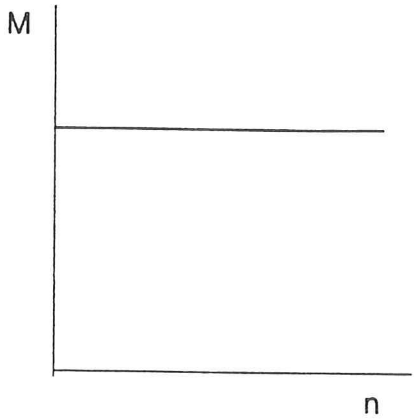


Torque / speed diagram
Torque is increasing proportional to n^2

MOTOR				V*I INVERTER			
				400V		500V	
Rated Power [kW]	Rated Current at 380V [A]	Rated Current at 400V [A]	at 500V [A]	Rated Current I_{nom} [A]	Maximum Current I_{max} [A]	Rated Current I_{nom} [A]	Maximum Current I_{max} [A]
7.5	16	15	12	21	21	24	30
11	23	22	17	21	21	24	30
15	31	30	24	32	32	24	57
18.5	37	35	27	40	40	46	57
22	43	41	33	43	43	46	57
30	59	56	45	60	60	46	102
37	73	70	54	70	70	82	102
45	88	84	67	88	88	82	102
55	106	101	81	111	111	82	205
75	143	136	108	143	143	164	205
90	171	162	130	216	216	164	205
110	209	199	159	216	216	164	205
132	250	238	-	240	240	-	-
160	302	287	-	305	305	-	-
200	376	357	-	380	380	-	-
250	470	447	-	450	450	-	-

NOTE:
- Rated current I_{nom} is the full load continuous current of the inverter (100% duty, *without* overload). It is part of the inverter type designation.
- On units type 500 V rated current I_{nom} is the full load continuous current of the inverter (100% duty), that allows overload current I_{max} = 125% I_{nom}.(inverter current limit) for 1 minute every 10 minutes.
- The maximum motor size is defined by its starting current I_A at line voltage. I_A must not exceed 7.5 times rated current I_{nom}

Table 2-3: INVERTRON V*I Selection for General Purpose Application (with overload capability)



Torque / speed diagram
Constant torque

MOTOR				V*I INVERTER			
				400V		500V	
Rated Power [kW]	Rated Current at 380V [A]	Rated Current at 400V [A]	at 500V [A]	Rated Current I_{nom} [A]	Maximum Current I_{max} [A]	Rated Current I_{nom} [A]	Maximum Current I_{max} [A]
7.5	16	15	12	21	26	24	30
11	23	22	17	32	40	24	30
15	31	30	24	32	40	46	57
18.5	37	35	27	40	50	46	57
22	43	41	33	60	75	46	57
30	59	56	45	60	75	82	102
37	73	70	54	88	110	82	102
45	88	84	67	88	110	82	102
55	106	101	81	111	139	164	205
75	143	136	108	143	185	164	205
90	171	162	130	216	278	164	205
110	209	199	159	216	278	164	205
132	250	238	-	305	381	-	-
160	302	287	-	305	475	-	-
200	376	357	-	380	475	-	-

NOTE: - Rated current I_{nom} is the full load continuous current of the inverter (100% duty), that allows overload current I_{max} = 125% I_{nom}.(inverter current limit) for 1 minute every 10 minutes.

- The maximum motor size is defined by its starting current I_A at line voltage. I_A must not exceed 7.5 times rated current I_{nom}

DC-Bus Circuit

- Precharge time..< 0.5 s
- Discharge time below 50 V .... typical 80 s
- Bus-bar connections 45,47 for braking unit (Part no. 850.92.00) or regen. unit REO (890.10. ..)

Control Transformer

- Line input voltage internal ....AC 460 V
- Control voltage secondary at PACS terminals 21 (+), 20 (COM) ....DC 24 V, max. 300 mA
  protected by fine wire fuse .... 1 AT
- Secondary voltage at terminals 0 (1) - 220 (2) ....AC 220 V
  (for braking unit supply only)

Table 2-4: Service Conditions

Temperature	- Operation IP00: 0°C up to +40°C ambient IP21: 0°C up to +35°C coolant air inlet temperature For temperatures higher than 40°C up to max. 55°C the nominal continuous current I_{nom} must be derated by1.5 % per °C - Storage : -25°C ... +55°C - Transportation: -25°C . +70°C (+70 during max. 24 hours)
Ambient relative humidity	max. 50% at 40°C unlimited max. 90% at 20°C during max. 30 days / year 75% average (Class F, DIN 40 040) *NOTE*: Condensation not allowed!
Air pollution	The ambient air may contain some dry dust but must not contain excessive dirt, chemical fumes, oil vapour etc.
Installation altitude	max. 1000 m above sea level. At higher altitude the output power is reduced! Please contact Reliance Electric.
Degree of protection	Chassis type: IP00 Cabinet type: IP21

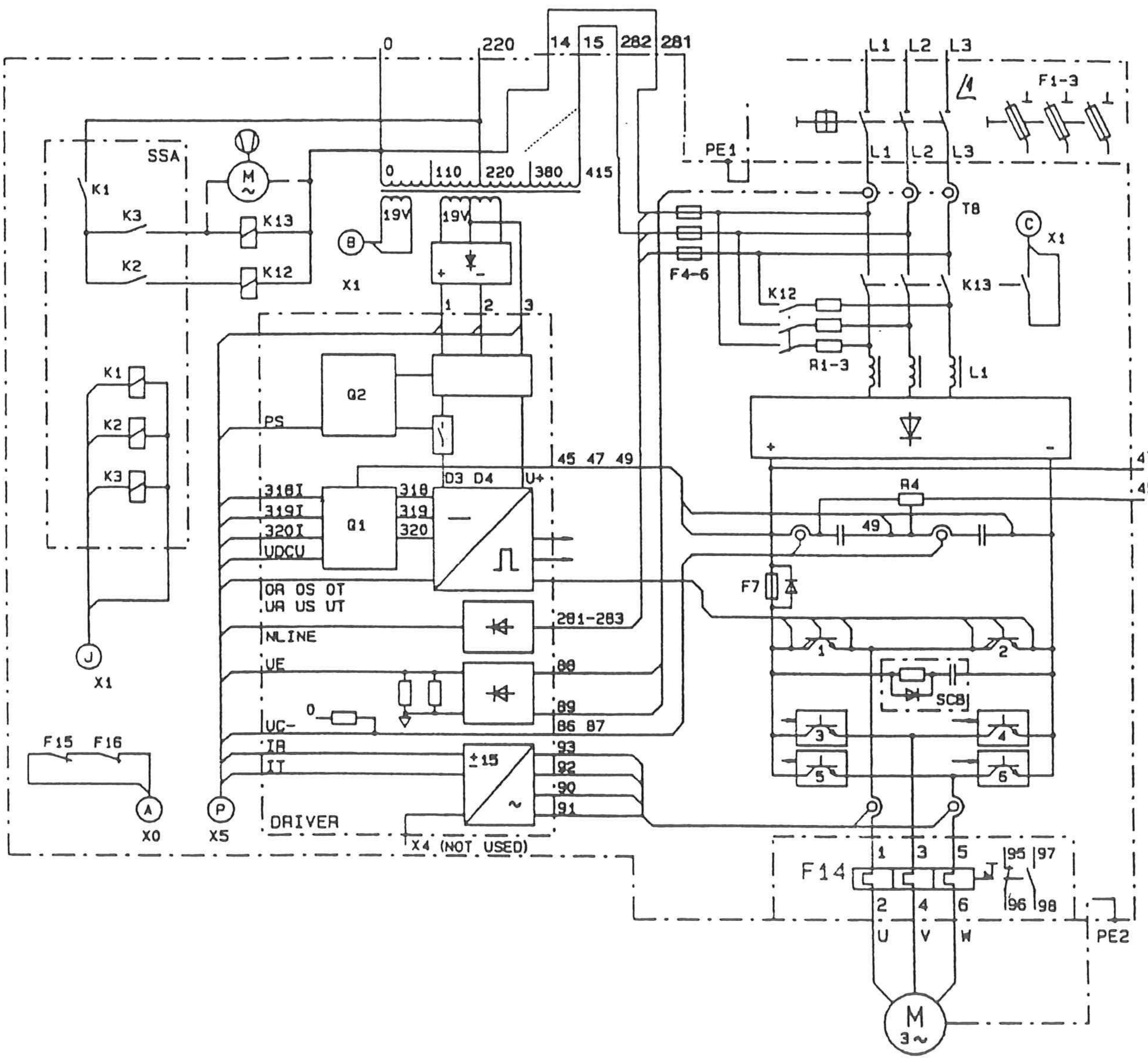
POWER CIRCUIT DESCRIPTION

RELIANCE ELECTRIC variable voltage, variable frequency controllers of the *INVERTRON V*I* series are devices which are ready for installation and are designed for driving induction motors at variable speeds. It operates on the principle of synthesized sine wave Pulse Width Modulation (PWM).

Figures 2-1 and 2-2 show the controller power circuit. Three phase line input voltage is applied to terminals L1(181), L2(182), and L3(183). Power is applied to the precharge circuit through the standard input fuses or fused isolator. Current transformer T8 senses ground fault currents.

Input power is also supplied ahead of the precharge circuit to the control transformer which supplies control voltages to the power supply diode rectifiers and interlock terminals 21 and 22. Terminals 21 to 22 are available for external interlocks and must be closed for the controller to operate.

When the Start command is given the precharge contactor K12 and the run relay will close. (Contacts for run indication are available). The precharge resistors R1, R2, and R3 switch in to limit the DC bus capacitor charging current. After the DC bus voltage reaches 95% of rated voltage, relay K3 will close, picking up contactor K13 (K23), and the precharge contactor K12 will drop out.



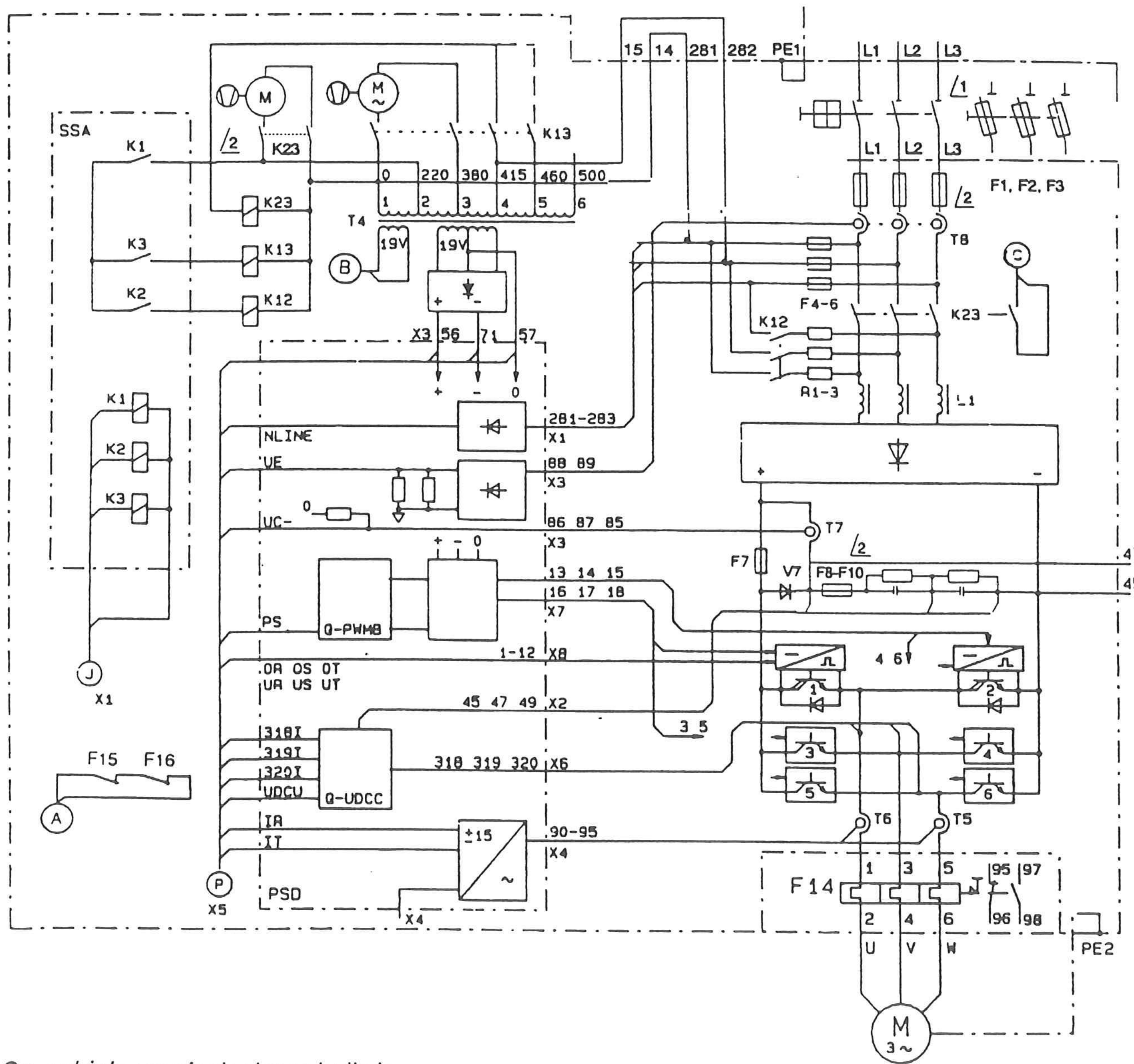
/1 On *cubicle version* isolator built-in. On chassis type fused isolator F1-F3 as option.

Fig. 2-1: Block diagram of the power unit with driver-card type 021..088, 400 V

The input line reactor L1 limits the rate of change of input current seen on the input power line and permits the drive to be operated on any size transformer up to the fault current rating of the fuses.

The diode bridge rectifies the three-phase input power to a dc-voltage of 1.4 times no load line voltage. This voltage is filtered by the DC bus filter capacitors. A DC bus capacitor discharge resistor R4 is sized to discharge the capacitors to 50 VDC within approximately 1 minute after power is removed from the capacitors either by a Stop command or opening the input disconnect.

The rectified, filtered DC voltage is fed to the transistorized inverter section which is operated to produce variable voltage, variable frequency output to the motor. The inverter phase transistors are switched by the base driver board and the inverter phase is fused by F7. Power modules with suppressing elements are combined for each phase to form a replaceable unit.
Two Hall Effect devices T5 and T6 provide current feedback to the regulator board.



/1 On *cubicle version* isolator built-in.
On chassis type V*I 111...240 the fused isolator F1-F3 is available as an option.
/2 On types V*I 305/380/450 fuses F1-F3, F8-F10 and additional blower are always built in. Diode V7 is not used.

Fig. 2-2: Block diagram of the power unit with PSD/PSE-card types 111...450, 400 V

MODIFICATIONS

Mounting the motor protection relay

If the device has been supplied without motor protection relay and this should be mounted later, the motor connection terminals (U,V,W) must be removed. The auxiliary contact of the motor protection relay (normal closed) must be wired to terminals 95/96 and the jumper removed (see connection diagram).

Mounting the line input fuses

If the device has been supplied without input fuses and these should be mounted later, the line connection terminals (L1,L2,L3) must be removed.
Remark: On units type 305/380/450 the fuses F1,F2,F3 are always built-in.

Control transformer adaptation (if required)

In the basic version of the 400 V units the line voltage phase L2 is connected through fuse F2 to the 415 V tapping of the transformer primary.
This allows input voltages 380/400 or 415 V $\pm 10\%$.
For voltage fluctuations of $+15\%$ on a 380 V supply line the phase L2 must be connected to the 380V tapping on the transformer primary. (Please contact Reliance Electric) .

Separate external control transformer supply (if required)

e.g. for applications with power line dip coast through it will be necessary to supply the control transformer via uninterrupted power supply.
In that case jumpers on terminals 281-14 and 282-15 must be removed and line voltage connected via external fuses to terminals 14 and 15.

CONNECTION

The following connection diagram Fig. 3-1 is a typical example for input and output power connections.
For signal and control inputs see regulator manual.

Connection Terminals	No.	Standard Function	Remark
AC-line input	L1 L2 L3 PE1	- Line voltage 3 x 380/400/415 V or 3 x 460 V or 3 x 500 V - Protection earth connection	Options: - AC-disconnector or fuses F1-F3 built-in
AC-Motor	U V W PE2	- Motor terminals U1, V1, W1, PE - Protection earth connection	Option: - Motor protection relay F14 built-in
Braking unit or Regenerating unit	45 47 0 (1) 220 (2)	- DC intermediate circuit - Supply AC 220 V	Common cable, max. 2 m long, fused not available on types 460 V, 15...40 HP
External regulator supply	281-14 282-15	- internal regulator supply via fuses F4,F5 and jumpers on terminals 281-14, 282-15	remove jumper for external regulator supply

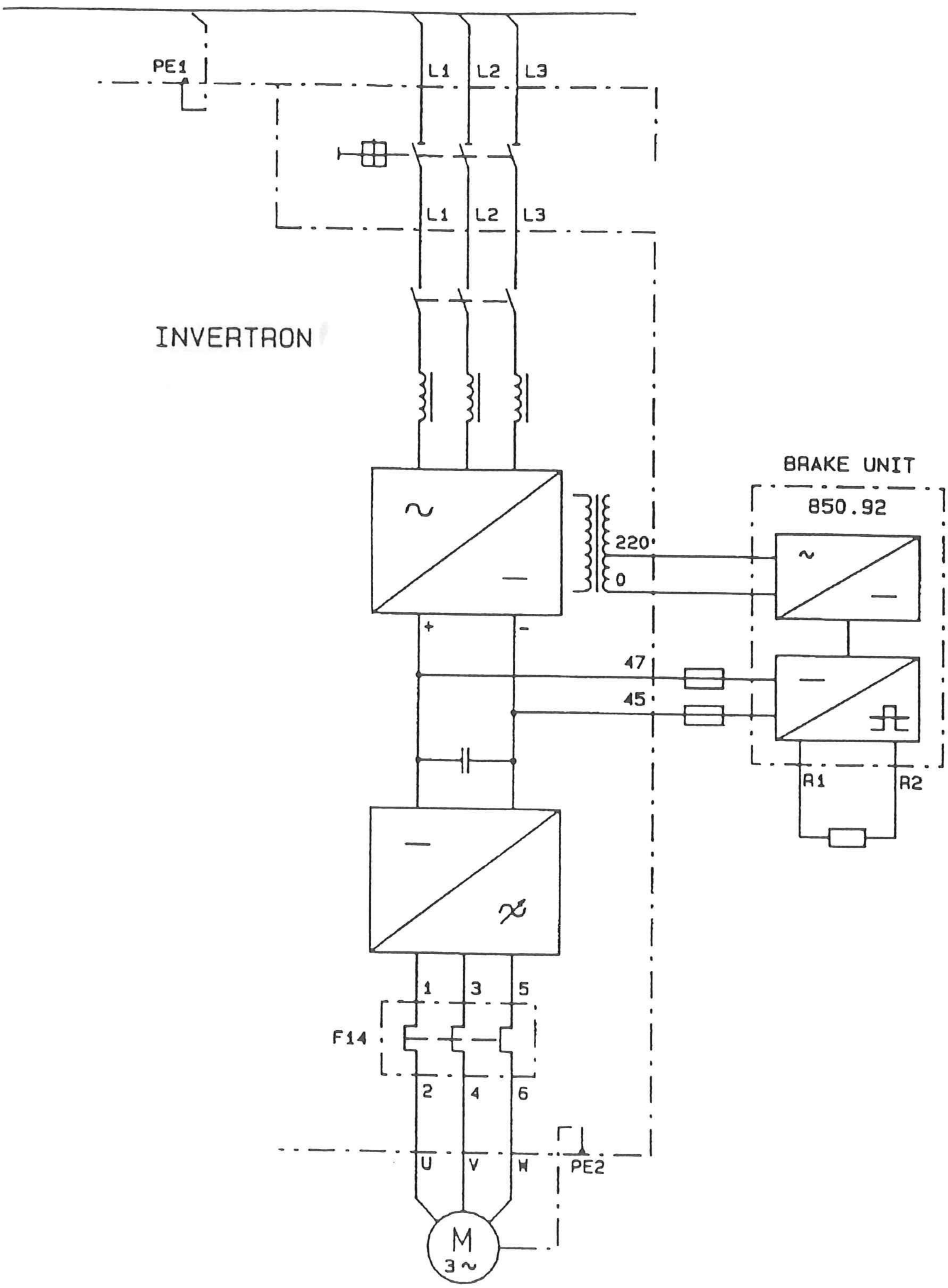
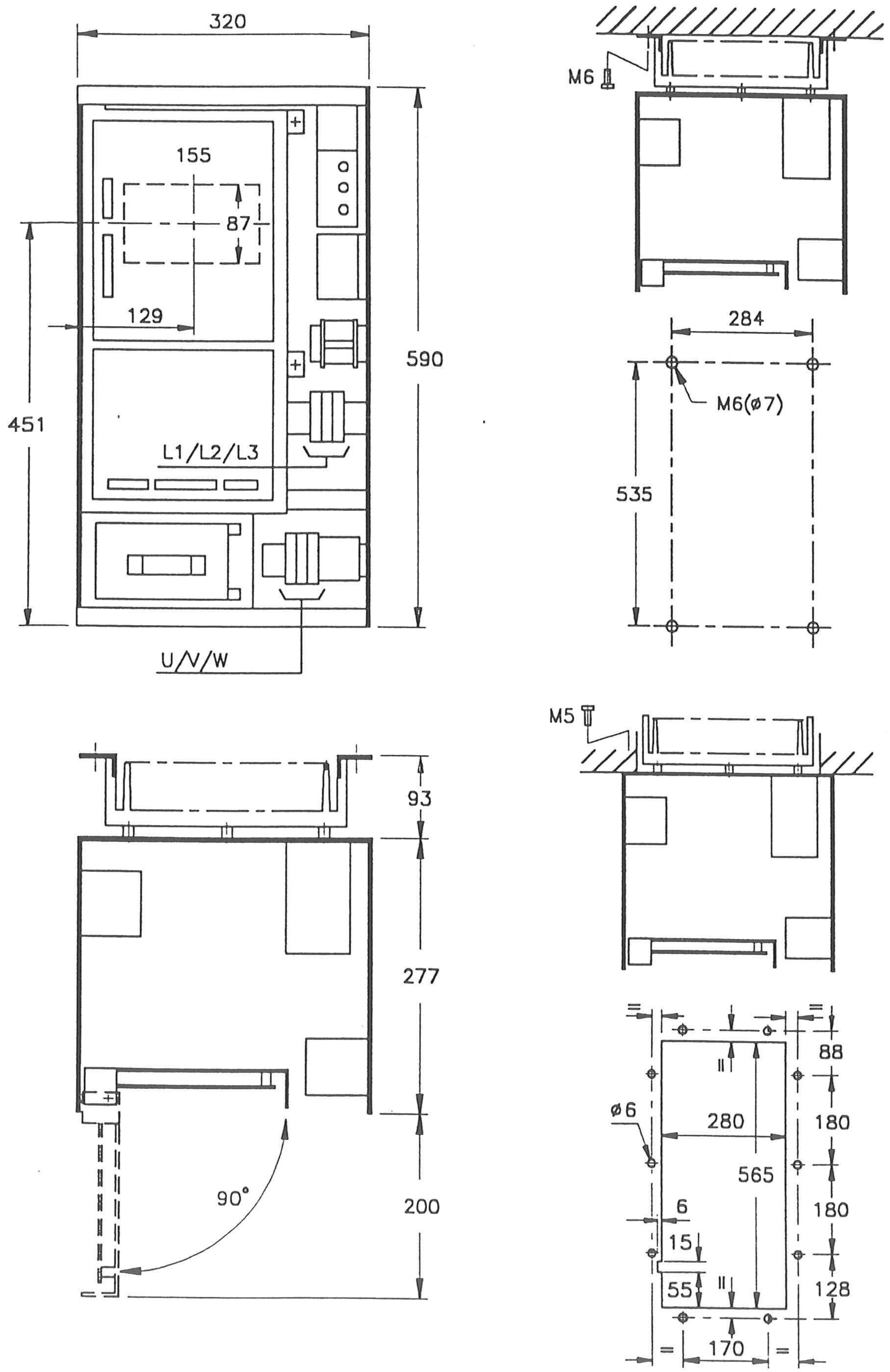


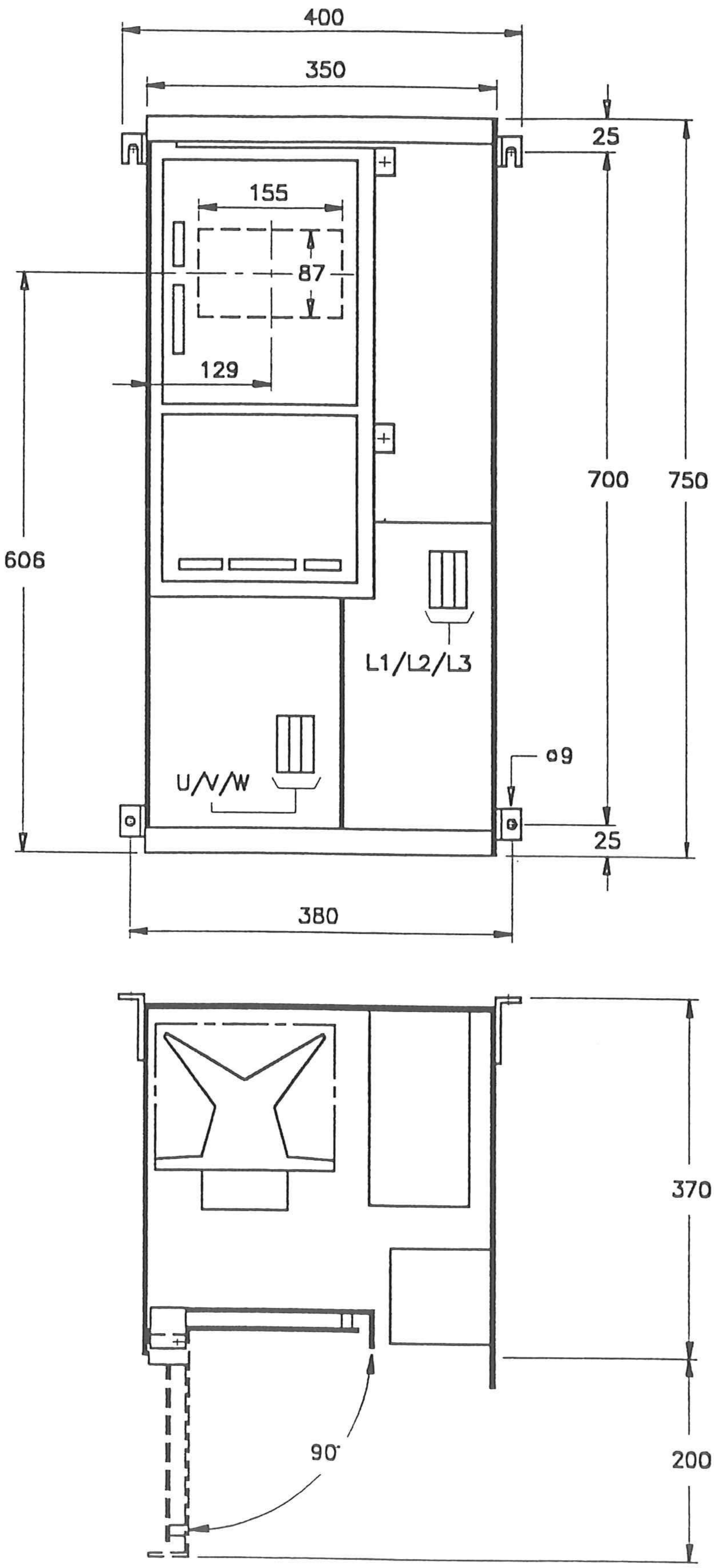
Fig. 3-1: Example for power unit connections

Dimensions



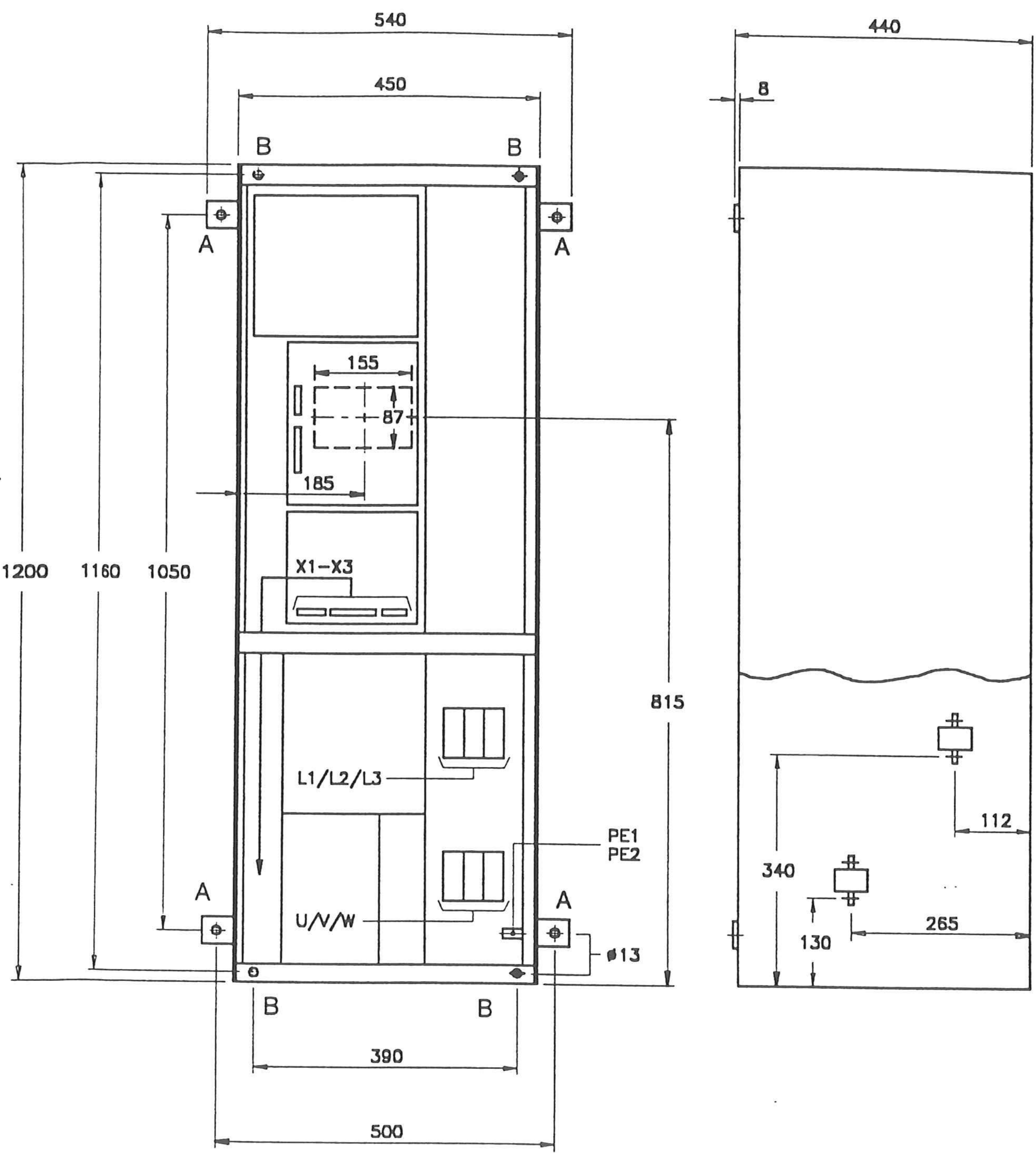
Weight: 35 kg

Fig. 3-2: Dimensions of the chassis unit IP00 Type V*I 021 / 024 / 032



Weight: 56 kg

Fig. 3-3: Dimensions of the chassis unit IP00 type V*I 040/043, 046, 060/070 and 088

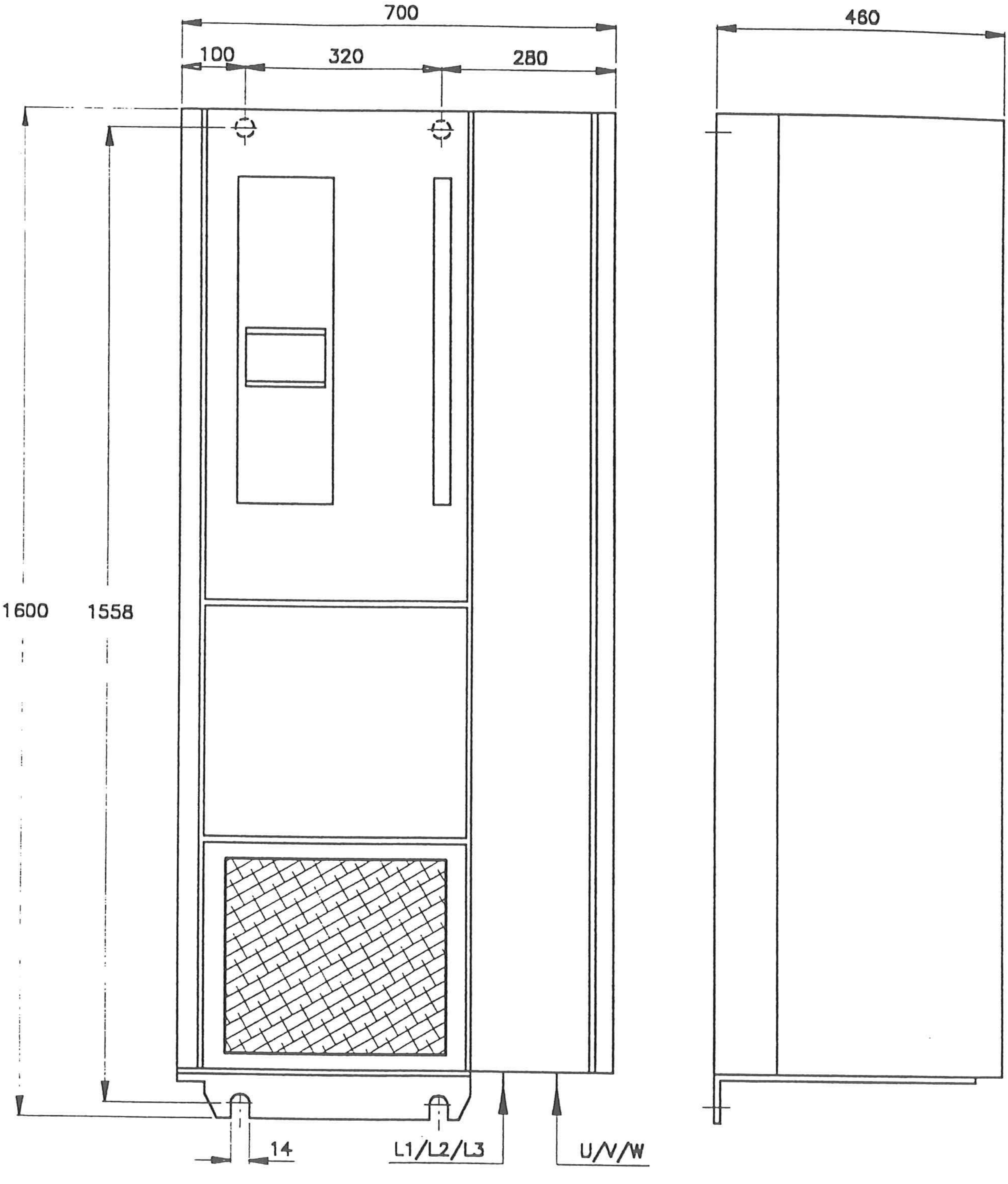


Operate only with covers inserted, to ensure correct cooling air flow
Brackets A may be removed, when using B for mounting the unit

Cooling air 830 m^3/h

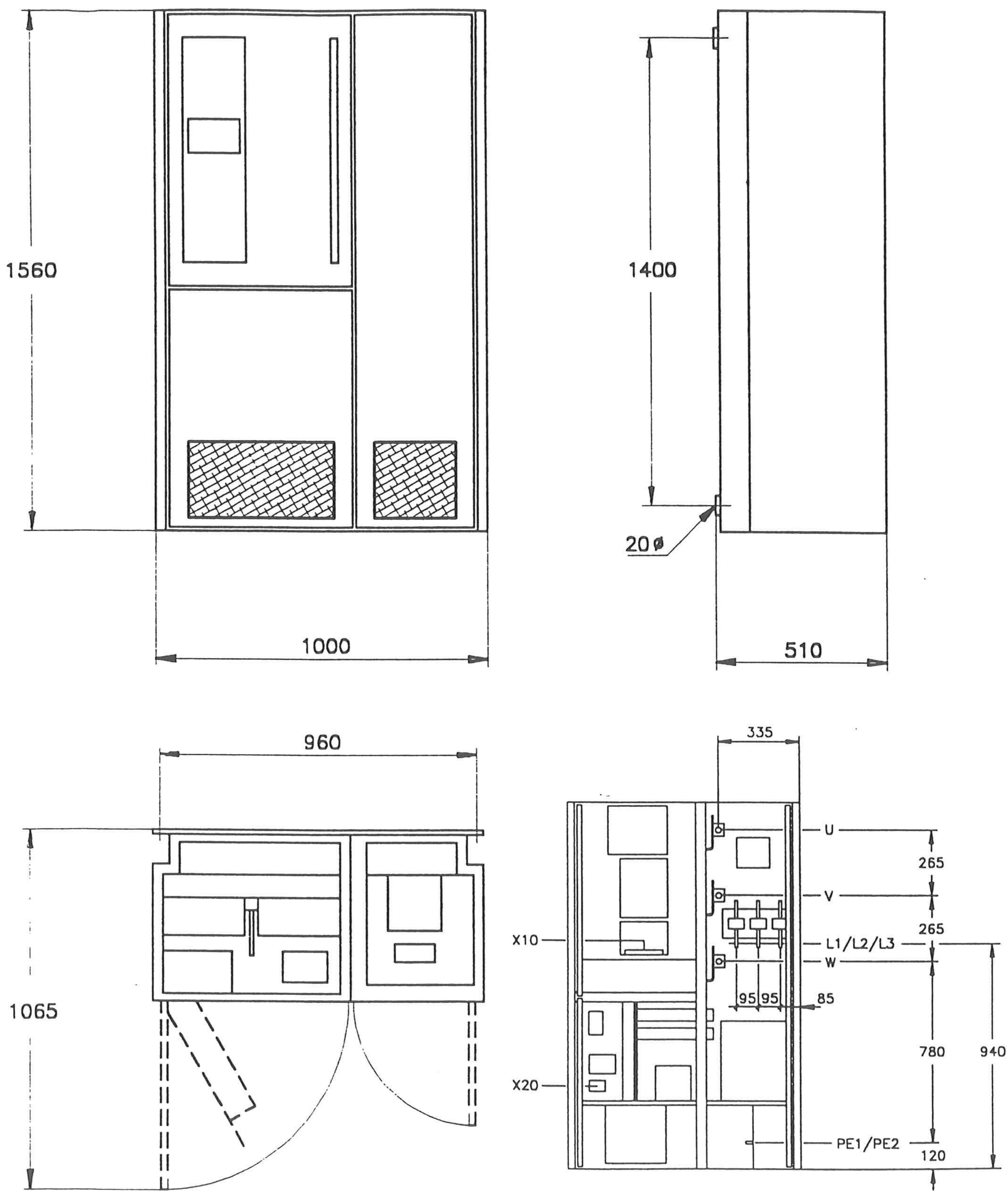
Weight: 128 kg

Fig. 3-4: Dimensions of the chassis unit IP00 type V*I 082, 111 and 143



Cooling air:		2020 m^3/h
Weight:	Type 164	225 kg
	Type 216/240	240 kg

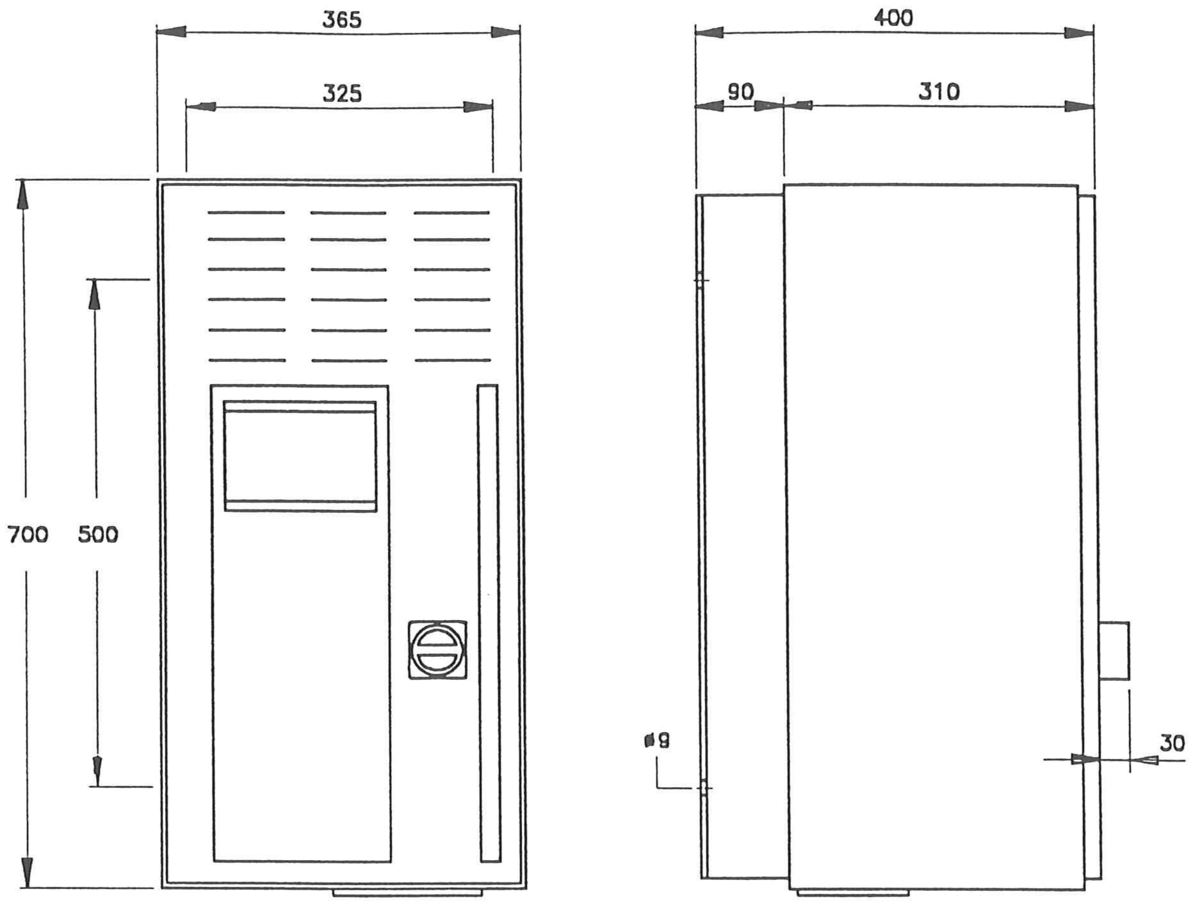
Fig. 3-5: Dimensions of the chassis unit IP00 type V*I 164 and 216/240



Cooling air: 2850 m^3/h

Weight: 425 kg

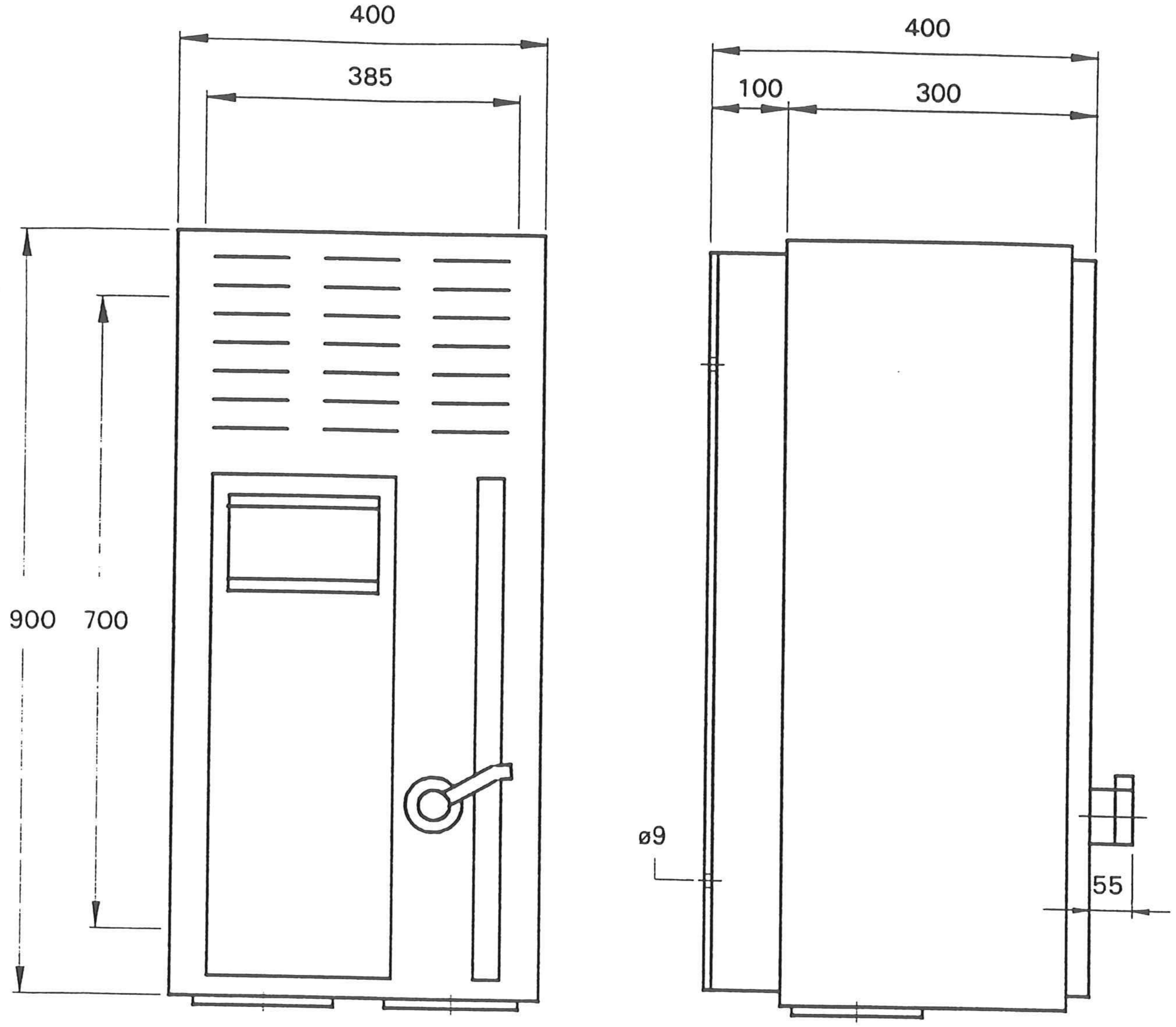
Fig. 3-6: Dimensions of the chassis unit IP00 type V*I 305/380/450



Cooling air : 160 m^3/h

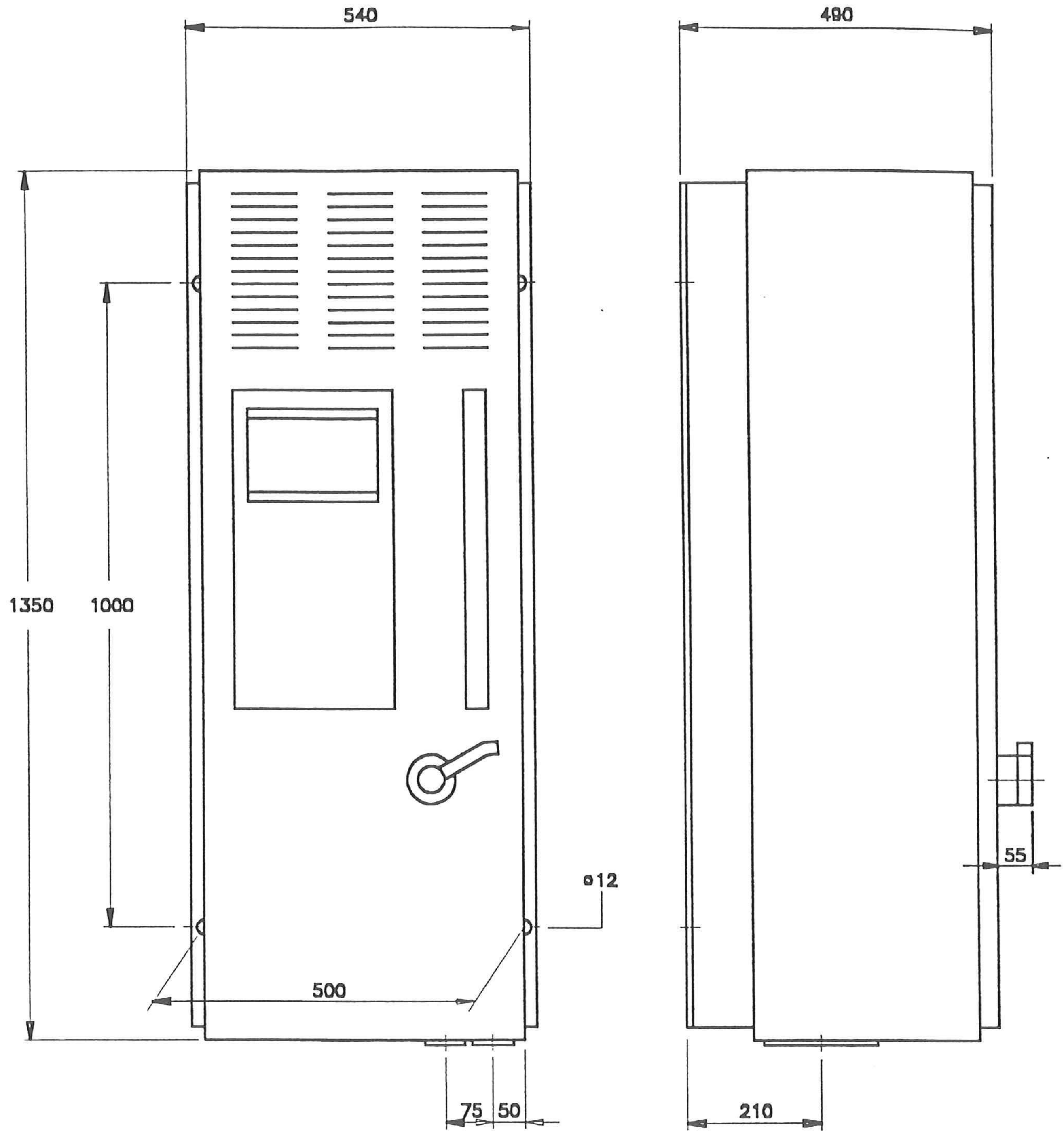
Weight: 49 kg

Fig. 3-7: Dimensions of the wall mounted cabinet IP21 type V*I 021 / 024 and 032



Cooling air :	on 040....070:	350 m^3/h
	on 088:	830 m^3/h
Weight:	78 kg	

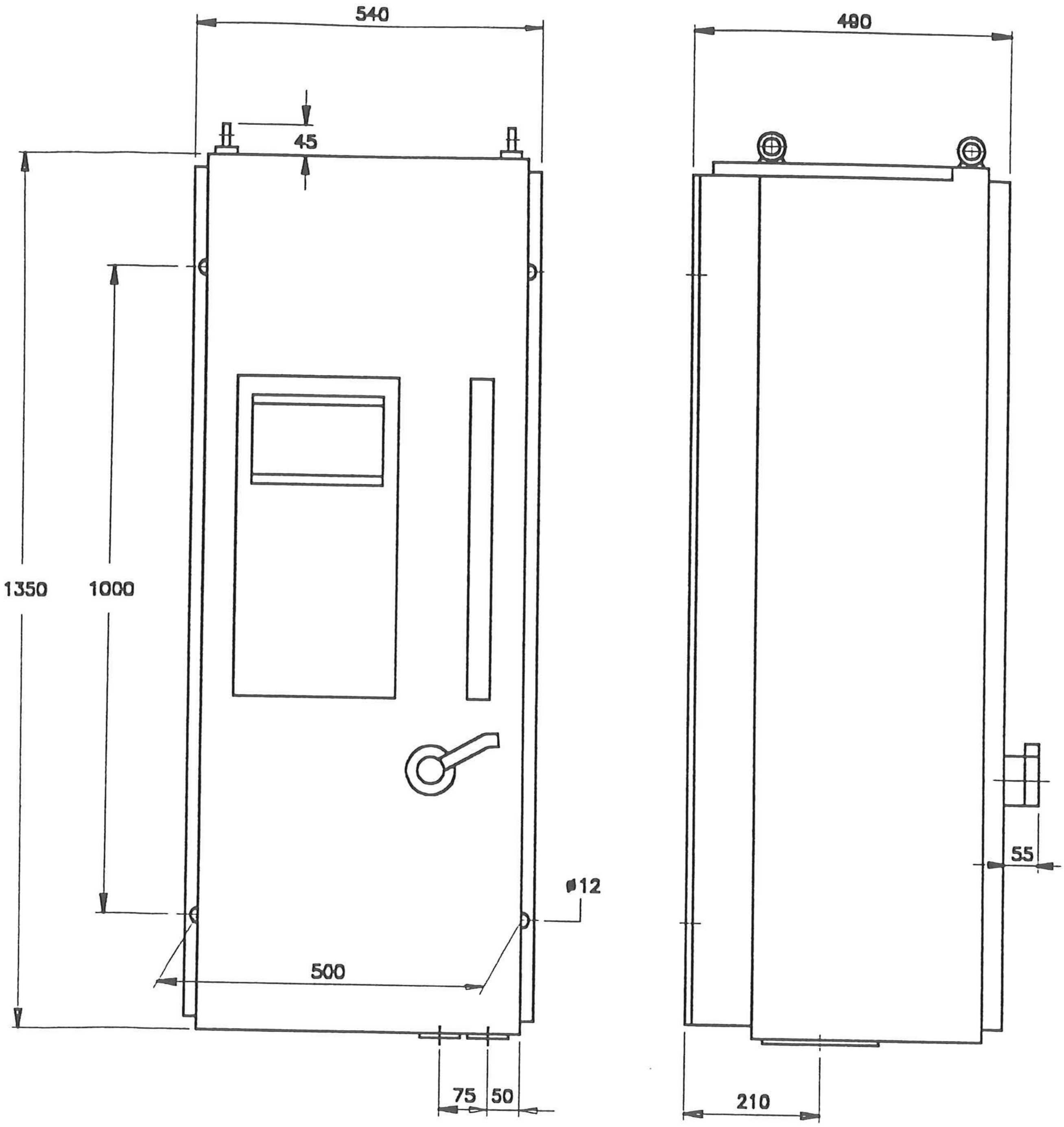
Fig. 3-8: Dimensions of the wall mounted cabinet IP21
type V*I 040/043, 046, 060/070 and 088



Cooling air : 830 m^3/h

Weight: 165 kg

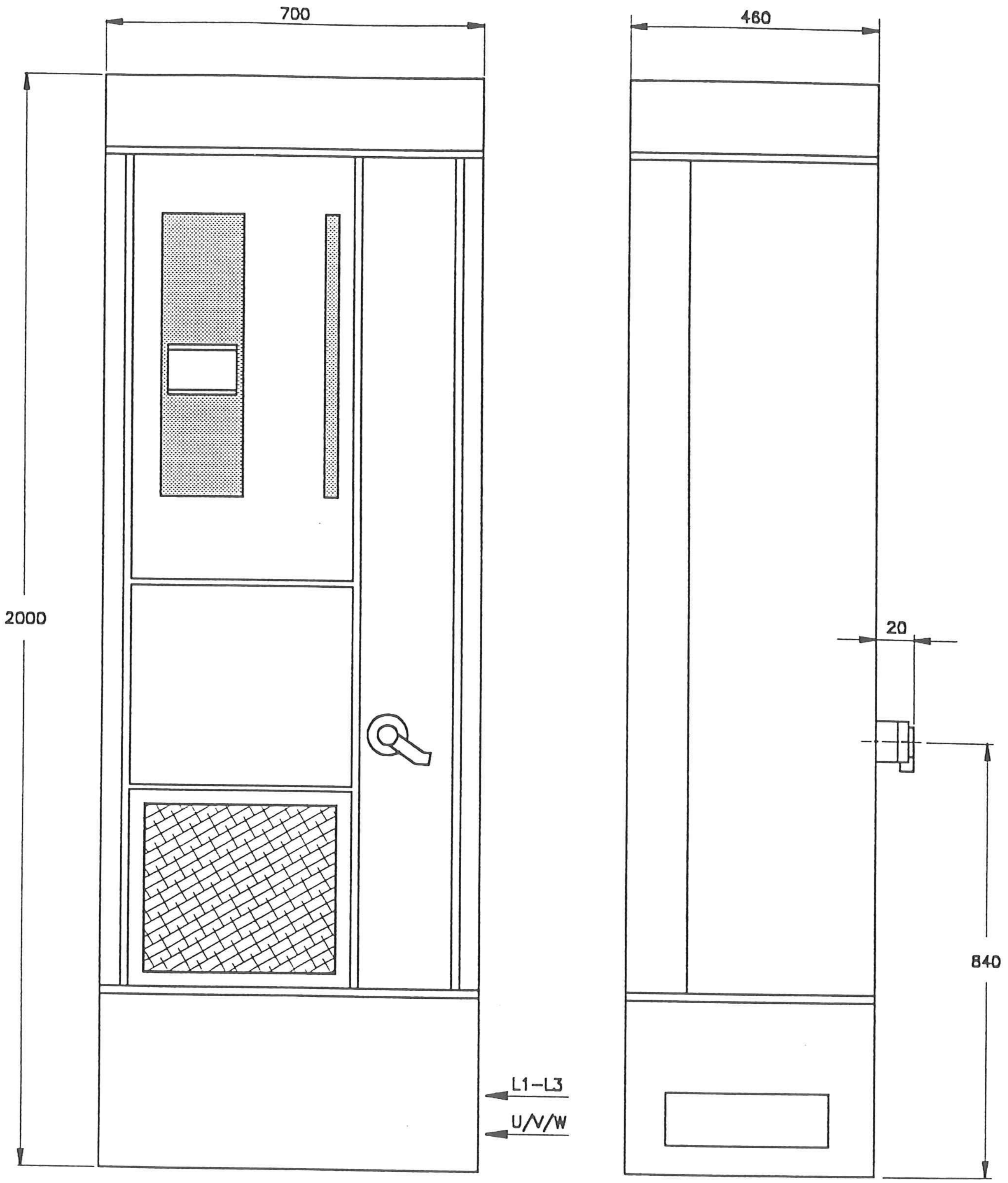
Fig. 3-9: Dimensions of the floor mounted cabinet IP21 type V*I 082 and 111



Cooling air: 830 m^3/h

Weight: 165 kg

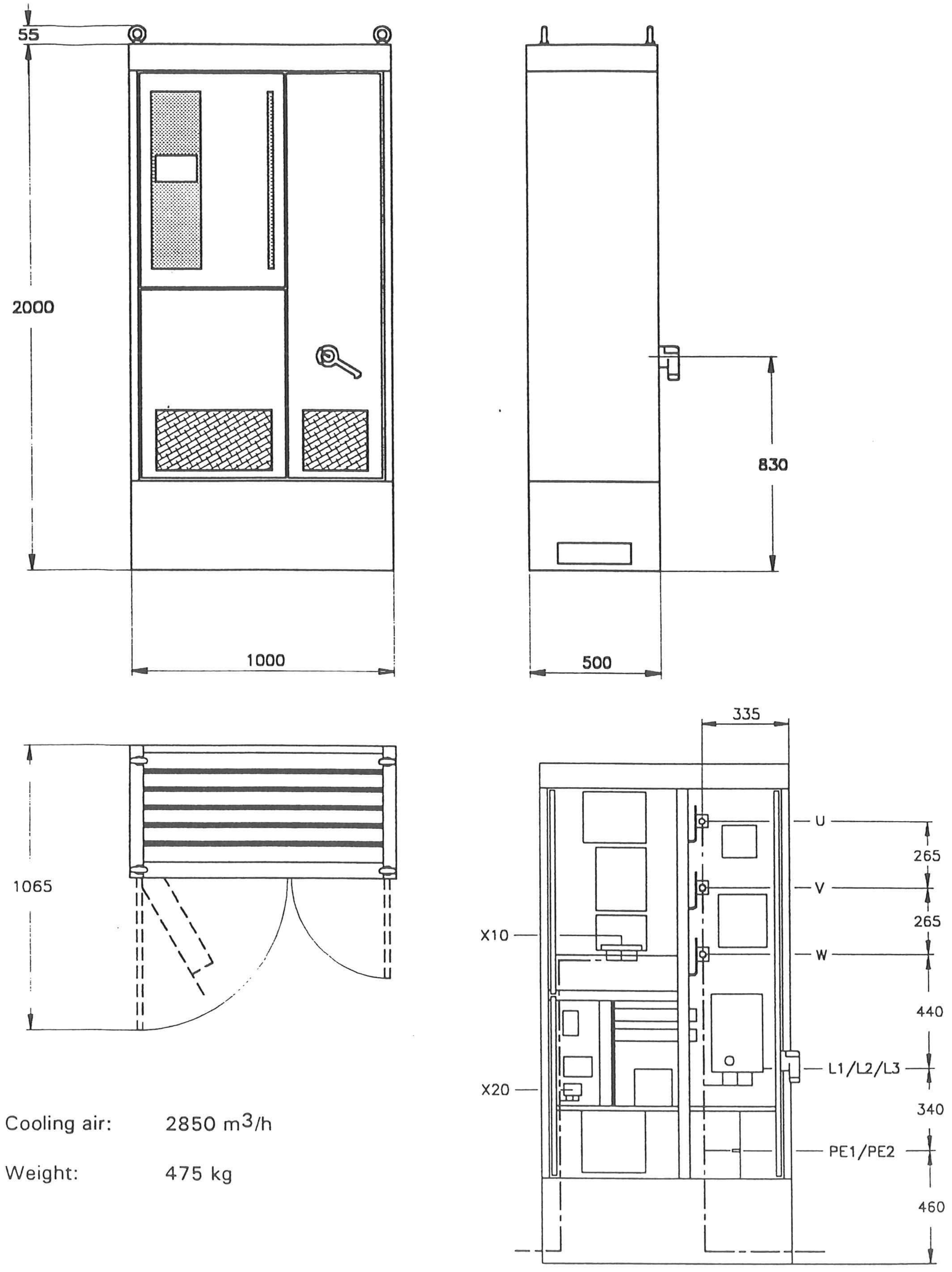
Fig. 3-10: Dimensions of the floor mounted cabinet IP21 type V*I 143



Cooling air : 2020 m^3/h

Weight:	Type 164	270 kg
	Type 216	284 kg

Fig. 3-11: Dimensions of the cabinet IP21 type V*I 164 and 216/240



Cooling air: 2850 m^3/h

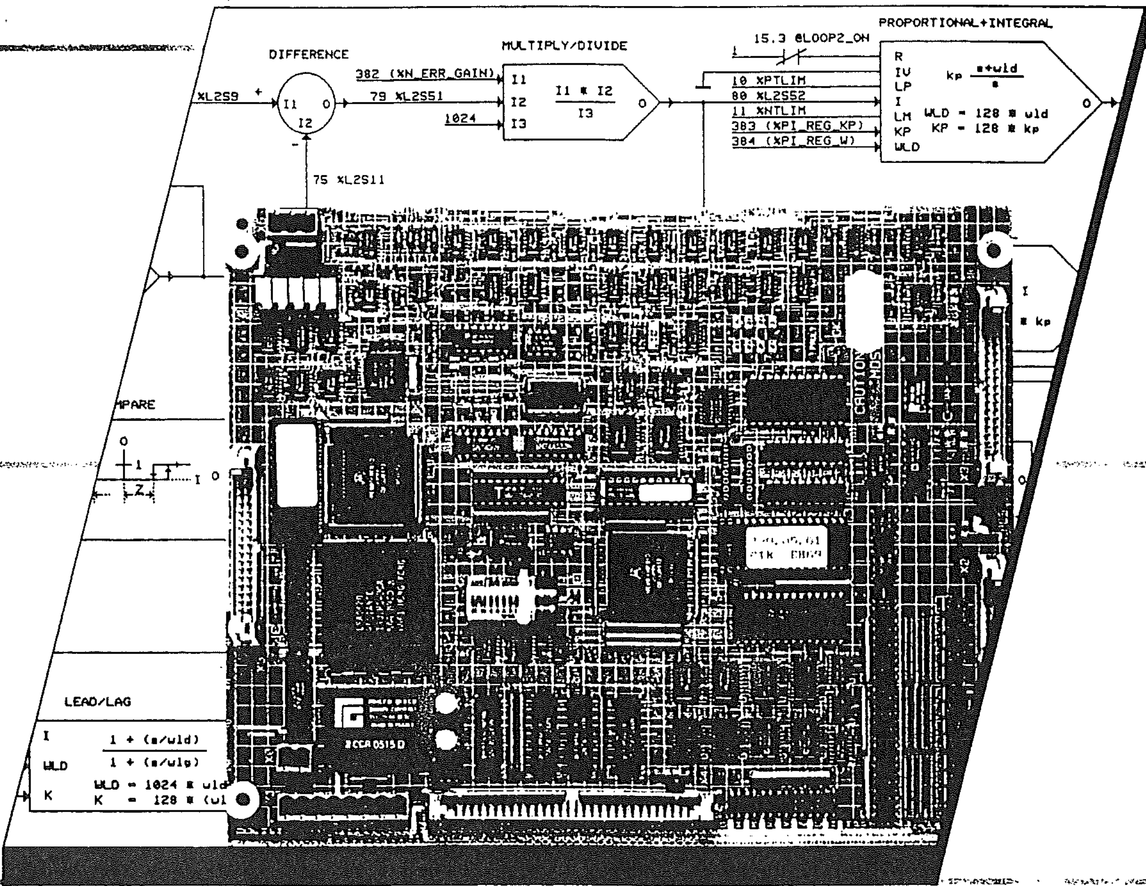
Weight: 475 kg

Fig. 3-12: Dimensions of the floor mounted cabinet unit IP21 type V*I 305/380/450

INVERTRON
Regulator VCI

Instruction manual
Betriebsanleitung
Instructions de service
Istruzioni di servizio
Manual de instrucciones

VCI



Firmware 789.00.03

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RELIANCE ELECTRIC

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General Notes

Guarantee

The Information in this manual is subject to change without notice. We do not guarantee the correctness of the content of this manual. We do not take any liability for damages caused by errors of the program. We always appreciate informations about errors, which will never be completely avoided

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Identifying the Equipment

The following section should be used for verification, that the equipment received matches what was ordered. The INVERTRON V*I family consists of several types of controllers (VTI analog, VGI digital with current minor loop regulation, VCI digital, current minor loop regulation, field orientation) built into different power modules for AC 380/415 V, AC 460 V, AC 500 V and DC-Bus 650 V ranging from 10 A (3 kVA, US: 5 HP) upto 450 A (US: 350 HP).
The following tables give a description of the available VCI-controllers including the digital regulator card MACS and accessories and their respective RELIANCE ELECTRIC US identifying model-numbers (M/N) and RELIANCE ELECTRIC EUROPE part numbes. For standard motors on applications with quadratischer load characteristic without overload capability or for general applications with overload capability the INVERTRON V*I is selected according to tables in the power units instruction manual.

Tab. 1-1: INVERTRON VCI Controllers

Input Voltage	Type		European Part No.
AC 380/415V	010		894.46.00
AC 380/415V	021		894.46.02
AC 380/415V	032		894.46.04
AC 380/415V	040		894.47.05
AC 380/415V	060		894.47.07
AC 380/415V	088		894.47.09
AC 380/415V	111		894.48.10
AC 380/415V	143		894.48.11
AC 380/415V	216		894.49.13
AC 380/415V	305		894.50.15
AC 380/415V	380		894.50.16
AC 380/415V	450		894.50.17
AC 500V	024		894.56.04
DC-Bus	010		894.66.50
DC-Bus	032		894.66.54
DC-Bus	060		894.67.57
DC-Bus	111		894.68.60
DC-Bus	216		894.69.63
DC-Bus	380		894.70.66
Input Voltage	**PS**	**US M/N**	**European Part No.**
AC 460V	5	4EE4005	894.66.00
AC 460V	20	4EE4020	894.66.04
AC 460V	25	4EE4025	894.67.05
AC 460V	40	4EE4040	894.67.07
AC 460V	75	4EE4075	894.68.10
AC 460V	150	4EE4085	894.69.13
DC-Bus	5	5EE4010	894.66.50
DC-Bus	20	5EE4020	894.66.54
DC-Bus	40	5EE4040	894.67.57
DC-Bus	75	5EE4075	894.68.60
DC-Bus	150	5EE4085	894.69.63

Firmware

-Set of 2 EPROM's	US M/N	European Part No.
VCI Standard and DC-Bus Version	0-48680-522UR	789.00.03

The set of two EPROM's consists of:

EPROM located at MACS-coordinates EH69 for B-Processor: 790.19.00
EPROM located at MACS-coordinates Y79 for A-Processor: 790.18.00

For software version numbers and indices see chapter 6.

Tab. 1-2: Spare Parts for VCI-Controller

	US Part No.	European Part No.
MACS-Card	0-48680-522B	804.46.20
PACS-Card	0-48680-521	804.59.01
Fuses on PACS-Card: 1 A		550.61.00
2 A		550.04.00

Remark: Up to August 1992 VCI-controllers with Part No's 892.XX.YY have been delivered. Due to major function extensions since that date the new MACS regulator card (Part No. 804.46.20) is now required in addition to the new EPROM Set.

MACS 804.46.**01** (old): for ~~VCI and~~ VCI as spare part for ~~VCI~~ 892.XX.YY
MACS 804.46.**20** (new): for VCI 894.XX.YY

Tab. 1-3: Pulse Tach Selection

Pulses per Revolution	Pulse Tach for Cable Connection Europ. Part No.	US Part No.	Pulse Tach with Plug Connector Europ. Part No.	US Part No.
512	992.95.00	613471-1A	992.95.10	613471-3A
1024	992.95.01	613471-1B	992.95.11	613471-3B
2048	992.95.02	613471-1C	992.95.12	613471-3C
4096	-	613471-1D	-	613471-3D

Plug for pulse tach ....European Part No. 560.93.01

Coupling to pulse tach ....European Part No. 996.54.00

NOTE: The desired maximum speed N_MAX together with the pulses per revolution PPR must not exeed the maximum input frequency 105 kHz.

$$\frac{N\_MAX\ [U/min] \times PPR}{60\ [s/min]} = \leq 105\ kHz$$

Interface

The following options can be installed as interface cards, depending on the approach. It is not mechanically possible to operate SDPM or InterBus-S cards (parameterization, references, control commands from AutoMax or InterBus-S) and the keypad simultaneously, as most of the keypad functions (parameterization, control commands, some references) must be blocked anyway during AutoMax operation. The part numbers for the SDPM card and the keypad vary according to the installation material supplied for the various power unit sizes.

Tab. 1-4: Keypad

Horse Power	Nom. Current A	US M/N	European Part No.
	10/ 21/ 32	-	921.88.10
	40/ 60	-	921.88.15
	88/111	-	921.88.22
	143/216	-	921.88.30
	305/380/450	-	921.88.11
5/ 15/ 20	7.5/ 23/ 27	5EC4090	921.88.11
25/30/ 40	33/42/ 50	5EC4091	921.88.16
75	95	5EC4092	921.88.21
150	191	5EC4093	921.88.30
>350		5EC4090	921.88.11
5/ 15/ 20	DC-Bus	5EE4094	921.88.10
25/30/ 40	DC-Bus	5EE4095	921.88.15
75	DC-Bus	5EE4096	921.88.22
150	DC-Bus	5EE4093	921.88.30
>350	DC-Bus	5EE4090	921.88.11

The diagnostic 7-segment display should be used as a minimum display during operation when using frequency converters, which are purposely installed without a permanent keypad, in order to completely block access to all registers (the keypad is only used for start-up and troubleshooting in such cases).
It is also advisable to use the diagnostic 7-segment display when using an interface card (SDPM, InterBus-S).

Tab. 1-5: Accessories for Maintenance

	US M/N	European Part No.
VCI MMI, PC-*Man Machine Interface* Set with Diskettes 3,5" and multi lingual manual:	7EC4096	788.00.01
Seriel interface cable for PC-connection via Keypad-	61C127	772.27.00
Diagnostic 7-Segment display for regulator card MACS		804.69.00

Tab. 1-6: Serial Dual Port Microbus (Unit with SDPM-Card, 4-Channel)

Horse Power	Nom. Current A	US M/N	European Part No.
5/ 15/ 20/ 25/30/ 40	10/ 21/ 32/ 40/ 60	6EC4094	921.89.11
75	88/111	6EC4095	921.89.21
150	143/216	6EC4096	921.89.31
>350		6EC4094	921.89.11

InterBus-S Interface Card (on request)

Tab. 1-7: Accessories for Drives with Regenerative Operation

	US M/N	European Part No.
Braking Unit	5EC4097	850.92.01
Regenerating Unit REO	5EC4098	890.10.00

Structure of the Documentation

How the complete handbook is organized

The INVERTRON V*I family consists of several types of controllers (VTI analog, VGI digital with current regulator loop, VCI digital, with current regulator loop and field orientation) built into different power modules for 380/415 VAC, 460 VAC and DC-Bus 650V, ranging from 10 Amps, 3kVA, (US: 5 HP) up to 443A, (US: 350 HP).

Therefore the handbook is split in several instruction manuals for each type of regulator:

- Manual V*I Regulator (individual for VGI, VCI)
- Manual V*I Power units (common for VGI, VCI)
- Manual V*I Keypad (VGI,VCI) or Operator Station manual (VTI)
- Manual MMI (Man Machine Interface, individual for VGI, VCI)

A complete INVERTRON VCI documentation contains the following manuals:

Register	Manual		Number
2	Regulator with Firmware EPROM Set		49'1316 739.00.03
3	Power unit or or	AC 460 V AC 400 and 500 V DC-Bus	49'1244 49'1246 49'1247
4	Keypad		49'1251
5	Accessories e.g. REO (Option)		49'1254
6	*Man Machine Interface* MMI		49'1303

1

The manual for the analog-controllers VTI covers regulator and power units, as the description is less complex.

DANGER, WARNING AND CAUTION

DANGER, WARNING, and CAUTION point out potential trouble areas.

All three of these forms are enclosed in a box to call attention to them.

A *DANGER* alerts a person that high voltage is present which could result in severe bodily injury or loss of life.

A *WARNING* alerts a person of potential bodily injury if procedures are not followed.

A *CAUTION* alerts a person that, if procedures are not followed, damage to, or destruction of equipment could result.

Summary of chapter contents

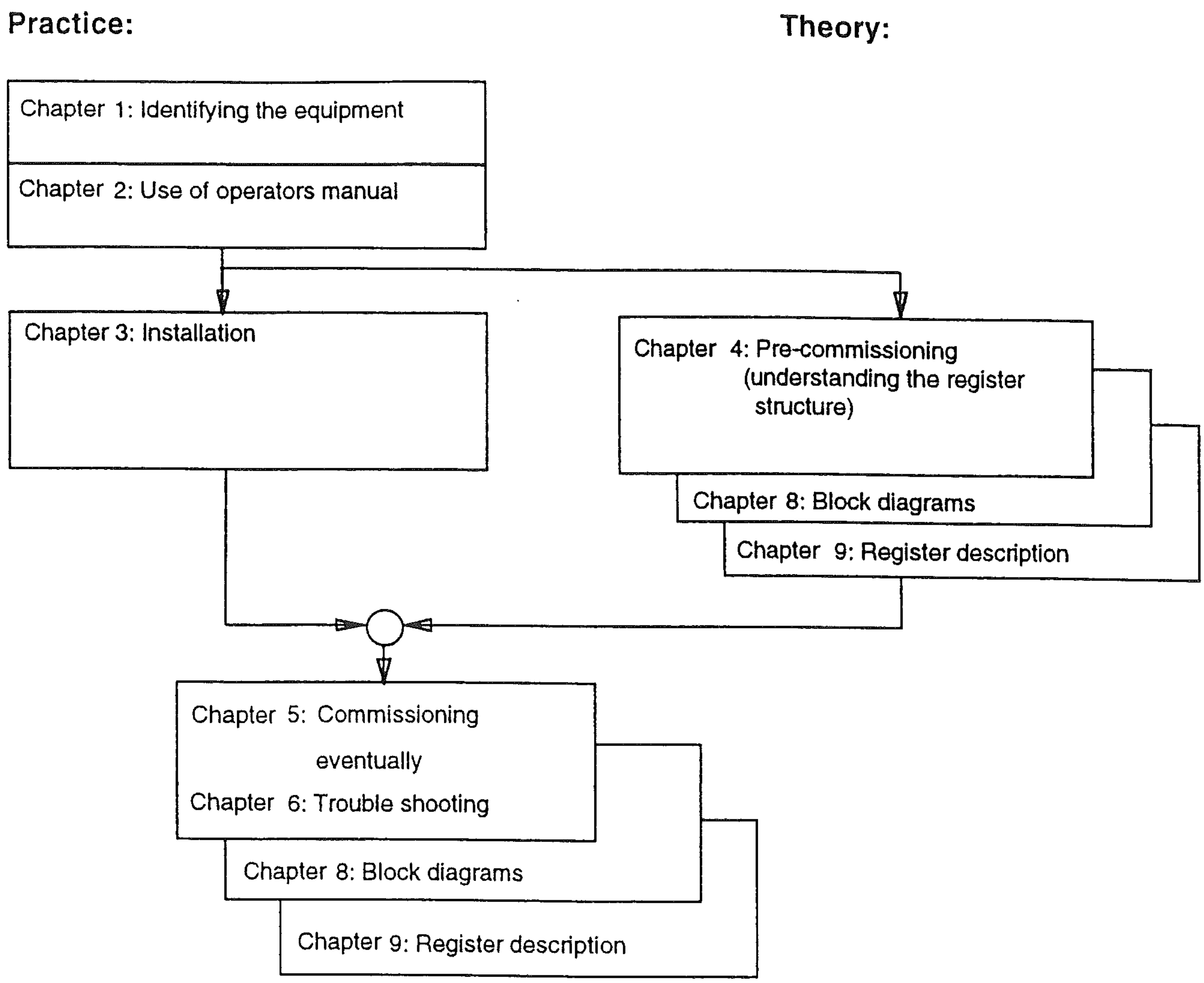
Chapter 3 - Installation
Describes the connections on the PACS terminal strip. Prior knowledge regarding the approach and the specialised terms explained in Chapter 2 is required. Chapter 3 differentiates between the installations which are always necessary, irrespective of the control source and the additional installations necessary for local operation.

Chapter 4 - Before start-up
As a purely theoretical chapter, chapter 4 is extremely important. It describes the register structure and syntax, and hierarchically lists all **input registers** according to functions. The aim of this classification is to avoid confusion in view of the detail and scope of chapter 4. The less experienced user is advised to refer to **Chapter 8 Block Diagrams and Ladder Diagrams** in conjunction with this chapter.
Chapter 9 features a detailed description of each register for reference purposes. Alternatively, this description is displayed via the PC man machine interface (MMI) when the registers are called up. The experienced user works mainly with the MMI and block diagrams. The table of registers in appendix A is rarely required.
The aim of this chapter is to give the user an overview of the available functions so that he can decide which register presettings must be altered in accordance with his approach.

Chapter 5 - Start-up
Extremely short in view of thorough preparation. Chapter 5 describes the necessary control steps on the drive - with and without mains voltage, the fine adjustment of the no load current and of the slip (optional with dynamic high-quality drives). The ex-works settings of the PI speed regulator is on the cautious side, i.e. the frequency and gain factor values are low, so that the drive continues to operate reliably even with mechanically light-weight, vibrating structures. Calibration of the speed regulator therefore almost always results in an improvement of the dynamic qualities. The voltage regulator for field weakening and the bypass current regulator rarely require calibration.

Chapter 6 - Troubleshooting

Fast diagnosis of reason for fault shut-down.


Practice:
Theory:
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Chapter 2: Use of operators manual
Chapter 3: Installation
Chapter 4: Pre-commissioning (understanding the register structure)
Chapter 8: Block diagrams
Chapter 9: Register description
Chapter 5: Commissioning
eventually
Chapter 6: Trouble shooting
Chapter 8: Block diagrams
Chapter 9: Register description

Technical Terms

Invertron VCI and VGI are two inverter families based on the same series of power units, see chapter 1.

The *VCI* is the "Flux Vector regulated inverter" for dynamically high speed regulation of AC motors as single drives. This inverter is based on the rotor flux oriented segregation of the power vector in the field and torque creating components. RELIANCE ELECTRIC's own gate array controls currents in 25µs pulse with variable switching frequency, matched to the dynamic demands of the moment.

The *VGI* is the inverter working in a voltage-frequency reference mode with subsidiary current control to provide default speeds for AC motors in single and multiple drives. This inverter works without speed feedback but, due to the rapid subsidiary current regulation (25 µs) pulse) ensures extremely stable operating characteristics even during rapid load and reference changes.

The controller card **MACS** (**M**icroprocessor board for **A**lternating **C**urrent **S**ystem) contains two microprocessors for all control functions, some communication functions and the rapid changeover of the coordinate-system and back again. In addition the module contains the RELIANCE ELECTRIC's own gate array for rapid control of motor currents in all three phases. The control module becomes a VCI or VGI control card through a set of EPROMS (for A- and B-Processor) ; see notes on limitation in chapter 1.

The supply card **PACS** (**P**ower supply for **A**lternating **C**urrent **S**ystem) contains the power unit for the controller supply voltage, the galvanic segregation of inputs and outputs, relays and the terminals for inputs and outputs, especially for the 'local operation'.

The inverters VCI/VGI permit the setting of parameters and control of a drive from diverse sources, in the following referred to as **control sources**. Control requirements and control confirmation (26)CTRL_SRC prevent conflicts. Depending on each application the following are available as control sources:

AutoMax ™ is a trade mark of DCS-(abbreviation. for **D**istributed **C**ontrol **S**ystem) distributed by RELIANCE ELECTRIC, a combination of digital drive system control, PLC and process control, designed in a uniform module hardware and software concept. Communication between AutoMax and VCI/VGI is enabled via the serial interface **D**rive **I**nterface **M**odule, in AutoMax and **SDPM** (**S**erial **D**ual **P**ort **M**icroBus, in the VCI/VGI drive).

- **InterBus-S (IB-S)** is a rapid sensor-actuator bus. Interbus-S, with real-time capability and an open communication system, is supported by more than 90 manufacturers, 30 of which are associated in DRIVECOM. It is their aim to advance a uniform drive technology which requires a communication on the bus, which is also content compatible. At the time of publication of this document the IB-S functionality is only available in limited Invertron VGI/VCI.

- **Keypad** is as comfortable control station, mounted on the inverter. Functions are: display of control source and control request, Start/Stop, jog and reversal of rotational direction, password input and access to all registers at all password levels, non-volatile storage of register contents and compare and search functions for temporary and permanently stored register contents, display function for selected output registers with free scaling and physical units, error storage in cleartext for approx. the last 200 turn-offs with hours run indication and error reset.

- **Man Machine Interface** (MMI), PC-based software functions via the serial interfaces on IB-S modules or keypad to offer an extremely simple facility for setting parameters for COMMISSIONING or provides free access to all registers in the 'change register'-mode. Manages register records with LOAD and SAVE (Save: transfer register from drive to PC, Load transfer registers from PC to drive) and context related writing to registers.

- **The PACS-terminal strip** is the simplest control source. It does not permit any control demands nor any register access. Operation via the terminal strip is known as **local operation**; this is the default control setting if no other control source makes a request.

VCI/VGI differentiates between the **operating modes run and jog**, which utilize completely different reference sources.

The following **operating states** are differentiated for VCI **"OFF", "READY", "RUN"** and **"RIDE THROUGH"**.

- **OFF** means open main contactor and (partially) discharged DC-Bus, so that a delay is created following a Start command due to the necessary initial DC-Bus charging phase.
- **READY** means the DC-Bus but is charged is without Start or Jog command, so that speed and current regulators are inactive.
- **RUN** means active speed and current regulators due to a Start or Jog command, so that the motor runs at reference speed or, in case of overload, in pull-out protection at a balanced speed.
- **RIDE THROUGH** denotes the behaviour of the inverter during Input Power failure. This means zero current, motor running and open main contactor as well as Run command at the control panel. This state is triggered by one of three monitoring units which monitor supply and DC-Bus voltage, some with variable trigger levels. The condition RIDE THROUGH ends when:
  - no monitoring device triggers within the pre-selected interval (288)MAXT_RTHRU and the run state is reactivated.
  - the pre-selected time has expired without voltage conditions reaching their set point reference and the VCI initiates an error turn-off.

For **Fault turn-offs** and **Warnings** VCI/VGI differentiates according to:

- **Trip**: Display faults causing a fault turn-off, independent of any consequential faults which may have occured during or after the fault turn-off. Various faults only occur for short periods and do not persist after the fault turn-off, e.g. motor overcurrent. Other faults persist even after the fault turn-off, e.g. motor overheating.
- **Pend. Trip**: Displays persisting faults which must first be removed before a fault reset is possible. This is not necessarily the fault which caused the fault turn-off.
- **Warning**: Displays a condition which after a time can lead to a fault turn-off, e.g. warning inputs (290)AUX1_DLY.
- **Indicator**: Displays a special inverter state which does not cause a fault turn-off.
- **Trip xx**: Displays a history of fault turn-offs with hours run indication to show, when the fault occurred.

The following function modules for VCI/VGI devices have abbreviations specific to Reliance Electric which require some explanation:

MOP (motor operated potentiometer) is an expression adopted from analog technology, meaning a reference integrator controlled by "faster/slower"-signals.

LVTU (linear voltage timed unit) is a ramp generator with variable acceleration and delay times.

Drives to be used to regenerate power from passive generator loads (e.g. centrifugal load to be reduced in speed) and active generator loads (e.g. load on a lift which is to be lowered) are treated separately. The VCI can be utilized without restriction for both types of load, as long as the return load is dissipated in the DC-Bus. The following options are available:

- **DC-Bus coupling** in the drive group with mixed motor/generator operation.
- **DC-Bus braking units** (Snubber) for single drives, with only occasional regenerative use. The return energy is converted into heat by resistors.
- **REO (Regenerative Unit)** regenerates power back to the AC line.

Connection of Inputs and Outputs independent of Control Source

Connection of Pulse Tach

For the operation of a rotor flux oriented inverter it is vital that the rotor position is known. Pulse tachs (increment generator) with 512 to 4096 lines per revolution can be used (see also chapters 1 and 7). For flux orientation, as well as speed feedback for speed control, the tach information is converted into rotor position.

The VCI must obtain its feedback from a pulse tach with an 8 to 10 V diffential output.

The maximum PG frequency must not exceed 100 KHZ.

Use only twin twisted cables of at least 0.75mm² (e.g. Reliance Electric cable with Europe stock No. 380.38.01) for all pulse tach connections.

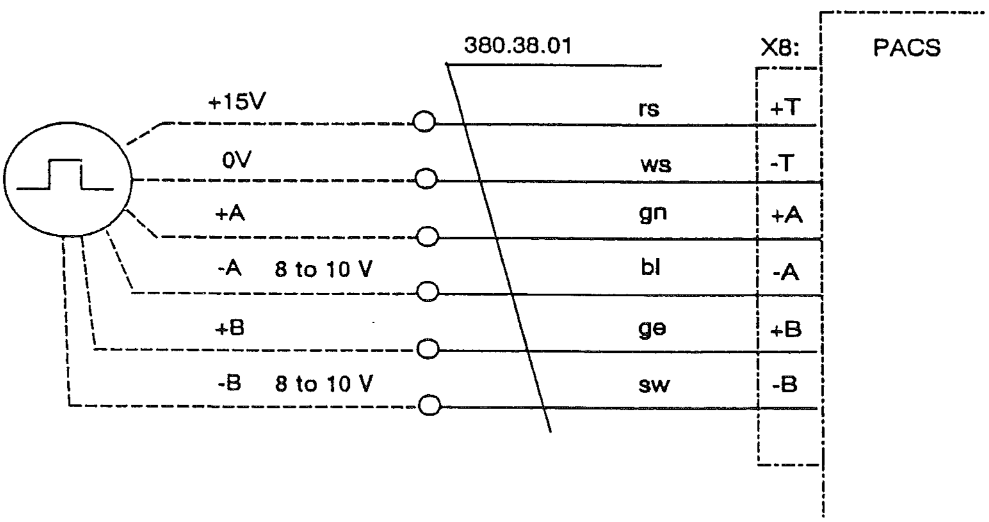
Terminals PACS X8:	Pulse tach input			
	Signal	Tach with cable connection colour of wire to cable 380.38.01		Tach with plug
T+ 200mA T-	Supply voltage VCC(+) Supply voltage 0V(~~earth~~)common	pink white	twisted twin	E F
+A -A	Channel A Channel /A	green blue	twisted twin	A G
+B -B	Channel B Channel /B	yellow black	twisted twin	B H

Configuration of Hardware Pulse Tach Supply

Ex works the MACS is equipped for a standard pulse tach (12V) and for cable lengths < 200 m.

Standard..insert link F

For cable longer than 200 m (max. 300 m) ....insert link E



Run Permission

(see wiring diagram control signals, page 3-7)

Terminals PACS X8:	Connected function → means that the terminal signal is shown on a logical signal.
21, 22	*Run permission* → I_RUNPERM The drive contains several protective measures which bring the drive to a standstill in appropriate form if a fault occurs. An essential component of the INVERTRON safety concept is a run-permissive button accessible to the user (contact: normally closed, opened when pressed) which functionally is comparable with ~~an emergency-stop-button~~ with a permissive function (interlocking). NON!

WARNING

The 'run permissive' operator must be installed in order to be able to bring the drive to a standstill with an interrupt function independent of any software configuration.
Non-adherence to this safety rule can lead to injury.

Control voltage outputs, operating interruptions, warning inputs

(see wiring diagram, page 3-7)

Terminals PACS X8:	Connected function → means that the terminal signal is shown on a logical signal.
21, 39	*24 V Output voltage* of PACS module to wiring of terminal strip.
33 - 39	*Function interrupt switch* as second Stop command which triggers a controlled linear deceleration action independent of (396)RAMPSTP_EN I_CUSTSTOP. unlike the Stop command via I_ON (the DC-Bus remains charged in case of function interrupts independent of control source) .
40 - 39 41 - 39	*Warning inputs* trigger a Stop command (three software selectable types of stop), if the associated contact is opened for a selectable time (see (290)AUX1_DLY and AUX_DLY) I_AUX1, I ... 2 Controlled linear braking or immediate removal of power from the motor can be selected for each warning input, see (424)AUX1_NC, (425)AUX2_NC. Stop commands via I_AUX1, I_AUX2 are fault turn-offs with entry into the fault storage register which holds approx. the last 200 fault turn-offs with details of cause and hours run reading. These records are safe from loss after power-off. Such error messages must be acknowledged.

Configurable binary inputs

(see wiring diagram, page 3-7)

The following 6 inputs are available as freely configurable binary inputs:

Terminals PACS X8:	Logic signal:	influence basic function:
26, 39	I_REVERSE	(499)P_REF_REV, (500)REF_RV_BIT
27, 39	I_REF2SEL	(483)P_RUNREF1, (484)P_RUNREF2 cancels effect of I_REF2SEL
30, 39	I_FASTER	Always influences MOP, which does not need to be used
31, 39	I_SLOWER	
40, 39	I_AUX1	(290)AUX1_DLY enables warning interval
41, 39	I_AUX2	(291)AUX2_DLY enables warning interval

Inputs have basic functions as described in the following section 'local operation', which are influenced by the register configuration. This can render any basic function inoperative so that the binary input can be used for user specific configurations.

The following are some examples of common configurations:

- A reference (Multiplexer) is selected from 8 different design values (with prefix) via 3 binary inputs. These references can be inverted in the prefix independent of selection, preferably using I_REVERSE.
- Up to 8 or 4 different reference ramps, separated for acceleration and delay, can be activated dependant or independent. These reference ramps can be changed over with the **motor running.**

The various reference sources (analog input, MOP, 2 multiplexers) can be used as speed, torque, torque limit and flux references but also as variable comparative values for freely configurable comparators.

Binary outputs (see wiring diagram , page 3-7)

Of the three relay outputs, (each with N/O and N/C contacts) two relays are freely programmable.

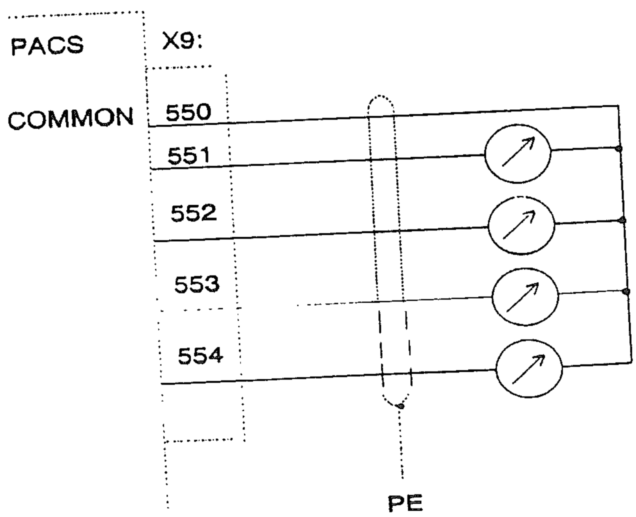
<table>
<tr><th>Terminals PACS X7:</th><th>Connected function</th></tr>
<tr><td>F1 - F2,
F3 - F2</td><td>Composite error display relay:
This relay is permanently connected to the composite error message O_NOFAULT, it is recommended to use this output to report the operating state. See analog WARNING outputs.
<table>
<tr><th>Status:</th><th>F1..F2</th><th>F2..F3</th></tr>
<tr><td>No supply voltage fault turn-off</td><td>closed</td><td>open</td></tr>
<tr><td>see(21)TRIP_CODE</td><td>closed</td><td>open</td></tr>
<tr><td>No fault (ok)</td><td>open</td><td>closed</td></tr>
</table></td></tr>
<tr><td>A11 - A12,
A13 - A12
A21 - A22,
A23 - A22</td><td>Aux. Relays 1 and 2:
Two freely configurable relay outputs dependent on any device signal, e.g. "actual value = reference value", "torque limiter active" standstill recognised".
<table>
<tr><th>Status:</th><th>A11 - A12,
A21 - A22</th><th>A13 - A12,
A23 - A22</th></tr>
<tr><td>No supply voltage</td><td>closed</td><td>open</td></tr>
<tr><td>Referenced binary signal 0</td><td>closed</td><td>open</td></tr>
<tr><td>Referenced binary signal 1</td><td>open</td><td>closed</td></tr>
</table>
For configuration of relay outputs see (489)P_AUX1 and (490)AUX1_BIT and (491)P_AUX2 and (492)AUX2_BIT.</td></tr>
</table>

<table>
<tr><td>Terminals PACS X8:
20 - 28</td><td>Main contactor feedback lamp
(see wiring diagram , page 3-7)
for operator stations with one illuminated (24V, 1W) start button.
The output of terminal 28 is internally connected to input I_MAINCONT, to indicate the aux. and control contacts of the main contactor are closed.</td></tr>
</table>

Analog outputs

Terminals PACS X9:	Connected functions
	Four analog outputs are freely configurable and enable a simultaneous display of the contents of four random registers for **ungrounded** display instruments, writing devices or for calibration purposes; also a potential free oscilloscope (via isolation transformer). Selection of registers which should be displayed using the pointer register [or cross referencing register].
551 - 550 552 - 550 553 - 550 554 - 550	*Analog output 1* with (480)P_AOUT1, pre-allocated with motor voltage *Analog output 2* with (481)P_AOUT2, pre-allocated with motor current *Analog output 3* with (482)P_AOUT3, pre-allocated with speed feedback *Service channel with* (540)DADR1, pre-allocated with test signal Analog outputs 1 and 2 function has a 20 ms cycle and may optionally enable a display filter ((418)NO_DAFILT). Analog outputs 3 and Service function has a 5 ms cycle without any filtering. The service channel allows variable scaling by the power of two ((541)SH1) for special applications while random floating decimal point-factors scaling factors are feasible for the three standard channels through display amplifiers ((338)P_MUL1/2, (340)D_MUL1/2, (339)M_MUL1/2). NOTE: The test reference potential of an oscilloscope without ground connection may only be connected for temporary calibration work to point CH107 on the PACS module, in order to realize improved fault suppression.

WARNING:
1) ANALOG OUTPUTS MUST NEVER BE GROUNDED!
2) Certain faults ((25)CORE_CODE >0) cause the contents of registers to 'freeze' which then no longer correspond to actual values. Safety relevant equipment which evaluates analog outputs, must achieve this together with an error indication (PACS-terminal X7: F1, F2, F2).



Local operation, connection of control and reference signals

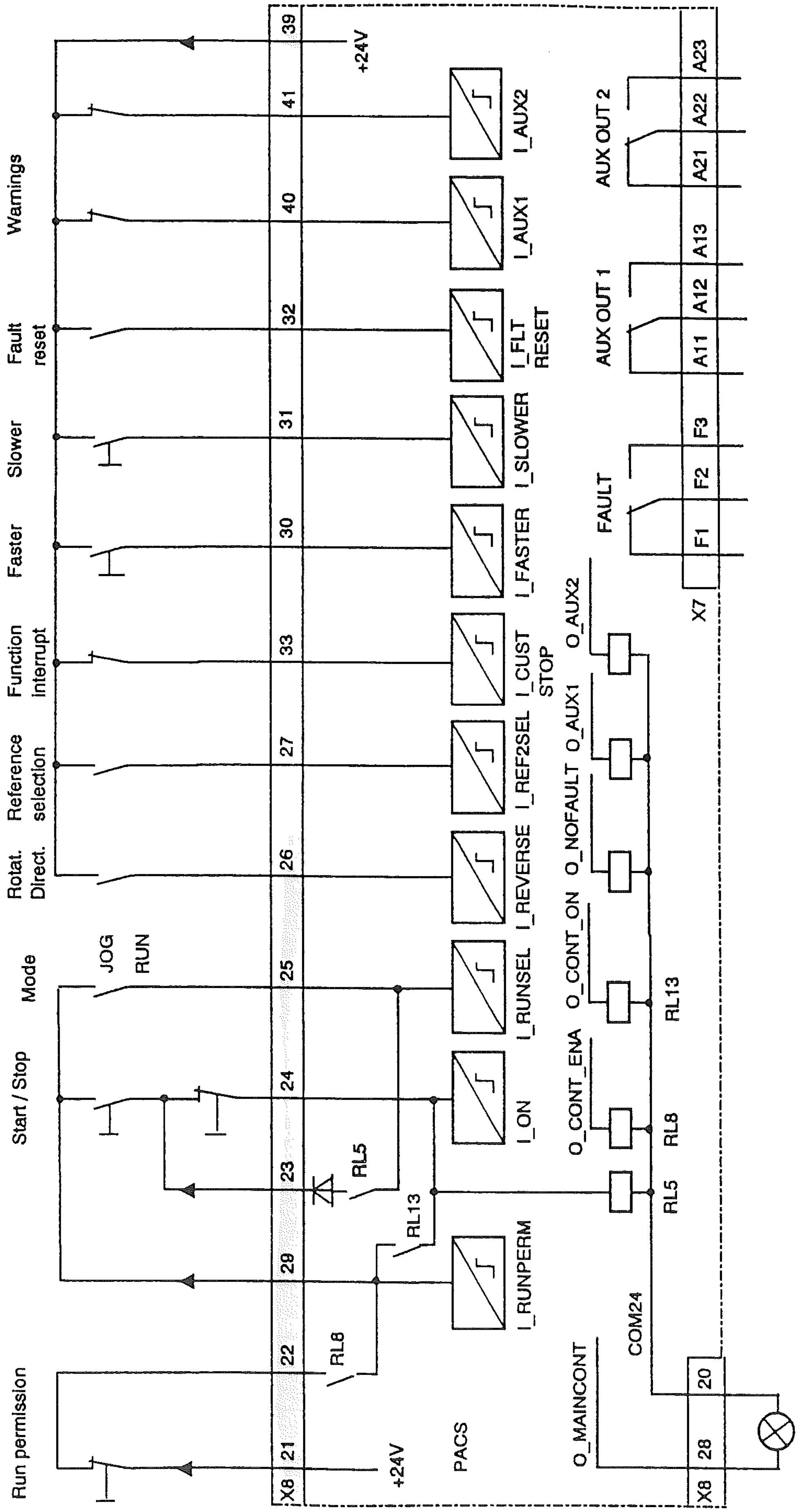
Selection of (RUN/JOG) mode and Start/Stop commands:

Terminals PACS X8:	Connected functions → means that the terminal signal will be displayed on a logical signal.
29	*24 V Output voltage* for wiring of start/stop terminals if the run permission is close externally (21,22) and internally with O_CONT_ENA .
25 - 29	*Mode selection switch* I_RUNSEL, enables sealing of a start impulse with closed switch (run mode) via RL5 and terminal 23.
23 - 29	*Start button* as N/O contact requires a closed connection (23, 24): I_ON - In JOG mode the start command is only active when the button is pressed. - In RUN mode the sealing (25), (RL5), (23), (24) also locks a start impulse.
23 - 24	*Stop button* as N/C contact cancels the Start command independent of whethe because of the start button or through self locking. I_ON. The effect of a Stop command can, depending on preference, represent a controlled linear deceleration action to standstill or immediate removal of voltage from the motor, see (369)RAMPSTP_EN.
24 - 29	*Start/Stop signal:* In the RUN mode the Start command should only be set or cancelle through <u>one</u> button or switch, terminal 23 will remain without hardwire connection.
32 - 39	*Fault reset button* as N/O, I_FLTRESET. As acknowledgement after fault removal or remedy this contact must be closed and reopened. For safety reasons a permanently closed contact cannot be accepted as automatic reset facility.

Editing speed reference (see wiring diagram control signals, page 3-7)

Terminals PACS X8:	Connected functions → means that the terminal signal will be displayed on a logical signal.
27, 39	*Reference selection switch determines* one of 2 available reference channels I_REF2SEL. Which reference source (analog input, internal MOP, reference multiplexer or digital reference register) should be connected to which reference channel is determined by (483) P_RUNRF1 and (484)P_RUNREF2.
26, 39	*Rotation reversal switch* permits the reversal of polarity of the speed reference after the selection of the reference channel I_REVERSE. The polarity of the speed reference can be fixed independent of I_REVERSE or be linked with other binary system sizes, see (499)P_REF_REV and (500)REF_RV_BIT.
30, 39 31, 39	*Faster button and* *Slower button* designed as N/O contact for a faster signal I_FASTER and slower signal I_SLOWER. These signals create a reference change at the output of function block MOP (internal reference integration) which, when the button is pressed, mirrors a predefined step width ((367)MOPSTEP) < 1s or a continual reference change, proportional to the duration for which the button is pressed ((365) MOPACC, (366)MOPDEC).

Wiring diagram: Control signals for local operation



Analog reference input

Terminal PACS X9:	Connected functions
167 - 157 and 156	*Isolated reference as voltage signal:* To supply a speed reference potentiometer an internal reference voltage supply (terminal 156) can be used. The common reference potential for internal isolated voltage source and analog input is terminal 157.
167 - 157	*Isolated reference as current signal:* If the polarity of the reference signal must be (-) on terminal 167, the reference must be taken from an external ungrounded power supply. (Since the only internal source (156) is a + Power Supply).
268 - 157	*Isolated reference as frequency signal:* when the reference potential is dependant on the type of frequency generator: The following 4 types of generator can be used: a) Open collector .... common terminal 271 b) Asymmetric 0V..+15V generator .... common terminal 271 c) Asymmetric 0V..- 15V generator .... common terminal 157 d) Symmetric +15V..-15V generator .... common terminal 157

Configuration of reference input

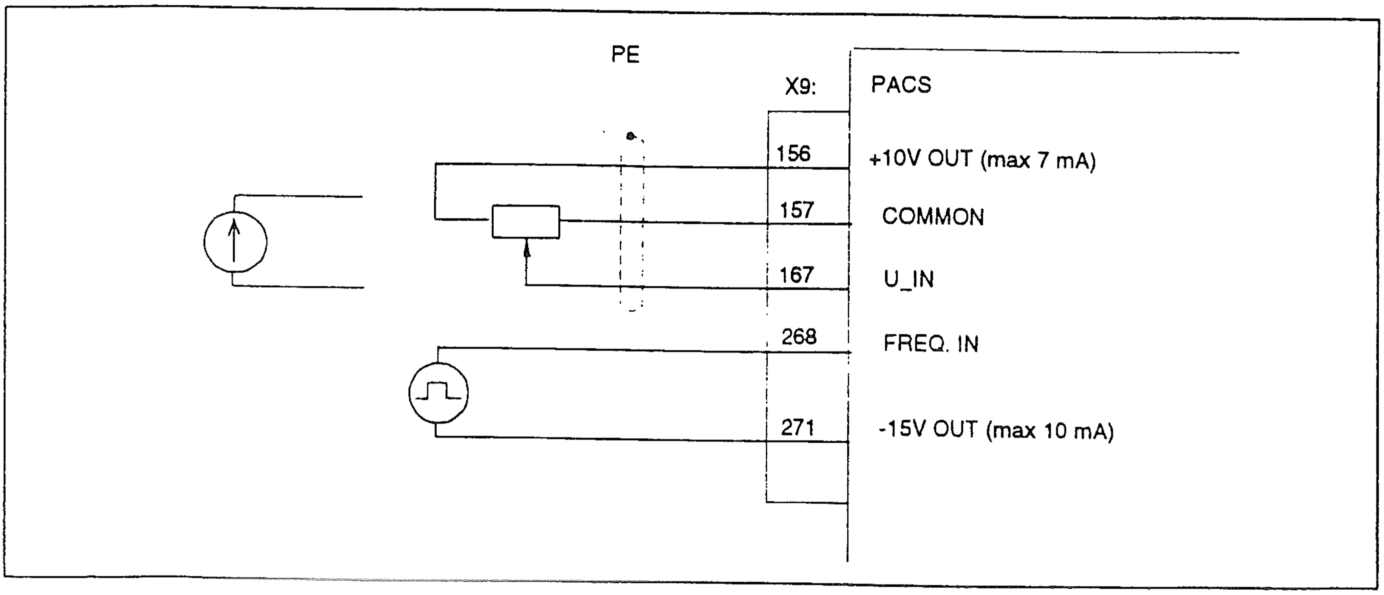
The analog reference input can be configured as voltage, current or frequency input.
The MACS module is despatched with links set for analog voltage input..

Standard: Jumpers H, J, L

For analog reference voltage or current .... set jumper H

For voltage input 0..10 V (+/-) .... set jumpers L,J
For current input 0..20 mA/4..20 mA .... set jumpers M,K
For frequency input 1..1000 kHz .... set jumper G

Coordinate position of jumpers: G......FX101-FX103 J.......GM100-GM102 L...... GR100-GR104
H......FX103-FX05 K......GM102-GM104 M..... GR102-GR104



Power Connections

Connection of a braking or regeneration unit REO
(Only for drives with generator operation)

> *DANGER*
> Only qualified electricians familiar with design and function of these drives may install, commission and/or maintain this drive and particularly the power unit. Non-adherence to this instructions can lead to serious injury or loss of life.

The power unit of a braking or regenerating unit REO is connected to the DC-Bus of the INVERTRON VGI or VCI. The DC-Bus terminals 45 and 47 are only accessible on some drives after the control unit has been moved aside. During operation the DC-Bus carries approx. 600V which only one several minute after the unit has been switched off. For terminal arrangement see layout in chapter 'spare parts' of the power unit manual for INVERTRON VCI/VGI 49 1246 or 49 1247 (460V).

In addition the connection and warning notices in instruction 49 1189 for braking unit or 49 1254 for regeneration unit REO must be observed.

Motor and mains connection

After opening the cover on the rigthhand. side you will notice two clearly separated and marked terminal blocks with respectively three terminals for mains connections L1, L2, L3 and the motor connections U, V, W. Avoid incorrect connection at all cost, as these would lead to damage on the power unit.
In order to prevent interference in the vicinity it is recommended that the mains cable between inverter and motor is screened and to connect the screen on both sides generously with a protective earth.

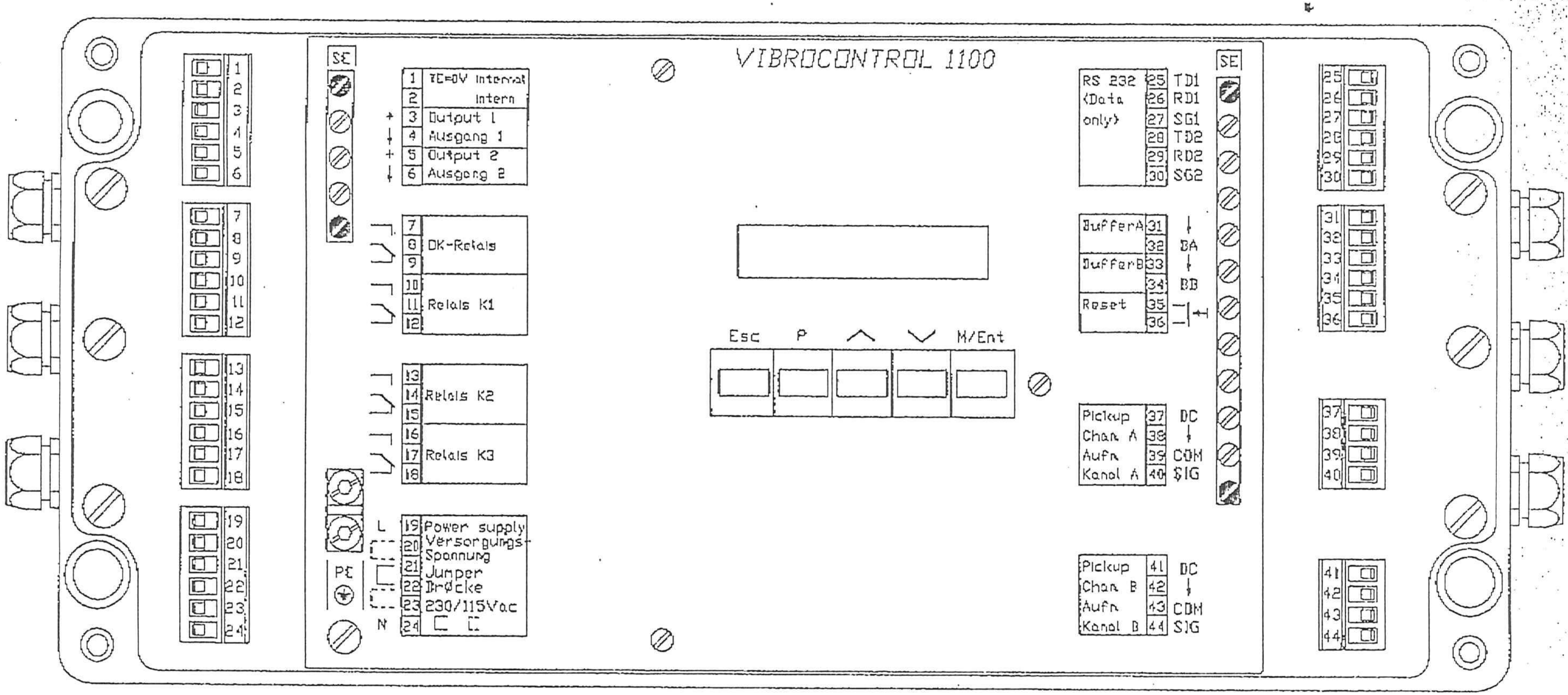
> *ATTENTION*
> On occasions users request the separation of motor and inverter using a three phase contactor.
> Switching this contactor during operations, particularly opening of contacts during RUN mode must be prevented.

NOTE:
Inverters (VCI/VGI) may for test purposes be run with open motor terminals. Contrary to conventional inverters which act as voltage sources, VCI/VGI monitors a switching pattern using their output current controllers with open output terminals as per block operation, i.e. in case of reference frequency = 0 a switching pattern which changes with the slip frequency can be observed.

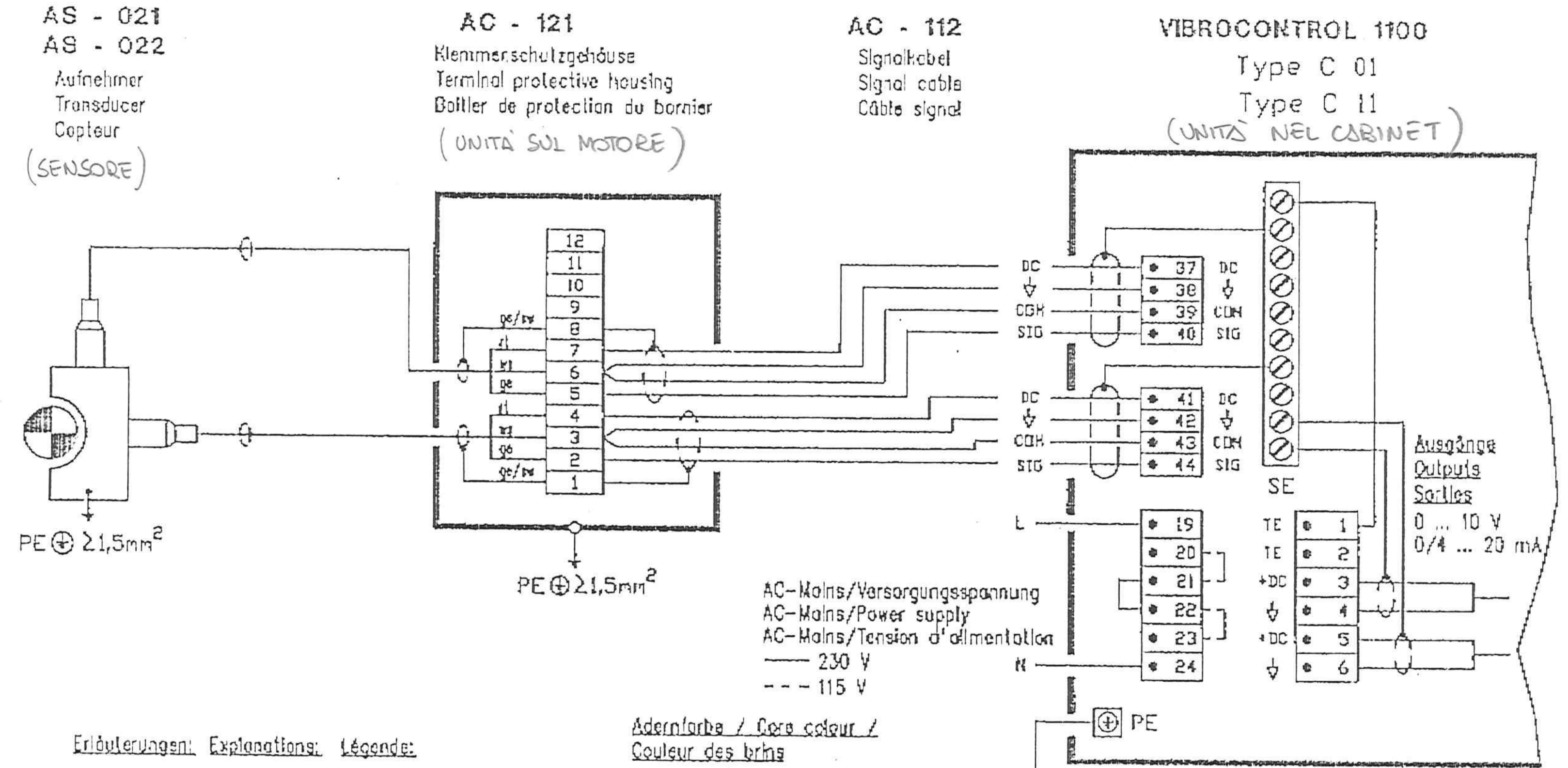
TLT FAX-Nr.: 06332-808267

Herrn Schweitzer, Abt 340

m.f.G. Pilchert, Tel 3644



K/VC/VC1TOTA (891003)



Erläuterungen: Explanations: Légende:

SE = Schirmerde / Shield earth / Blindage
⏚ = Bezugsleiter (0 V) der Elektronik / Zero (0 V) of electronics / zéro analogique de l'électronique (0 V)
⊕ PE = Schutzerde / Protective earth / Terre secteur
PA/⏚ PA = Potentialausgleich / Potential equalization / Point central de mise à la terre

Adernfarbe / Core colour / Couleur des brins

rt = rot / red / rouge
ws = weiß / white / blanc
ge = gelb / yellow / jaune
gs/sw = gelb/schwarz / yellow/black / jaune/noir

CPB201	CPB221	CPB233	CPB209	CPB202	CPB231

			Datum	Name	VIBROCONTROL 1100	SCHENCK CARL SCHENCK AG Postfach 4018 D-6100 Darmstadt 1	Verdrahtungsplan/Wiring diagram/Plan de raccordement für C01/C11 mit AS-Aufnehmer, 2-kanalig for C01/C11 with AS-Transducer, 2-channel pour C01/C11 avec AS-Capteur, 2-canaux	Zchg für Auftraggeber
		Bearb						
		Gepr	3.5.90					Zchg Nr CP1 206
Änderung	Datum	Name	Norm		Urspr / Ers für	Ers durch		Ausf 01 1 B

I:CP1 206 (900503)

3. MOTOR

3.1 TECHNICAL SPECIFICATION

Please find the data sheet on the following page.

The motor will be equiped with an encoder type HOHNER PB 05/5/9/0/6R/1024 which is a two pulse tracks 90° displaced, with complement output and a "zero" track.

The motor will be fitted on base plate.

The motor will be equiped with a radial vibration sensor type SCHENCK VIBRACONTROL 1100.C01.

The electronic control of the vibration sensor is installed in a can, near the motor. The measurement and the informations for the programming are displayed on a sixteen character screen and are easily accessible by using five keys.

ID 09/91

JEUMONT SCHNEIDER INDUSTRIE
GROUPE SCHNEIDER

4. DATAS

ID 09/91

4.1 CONVERTER

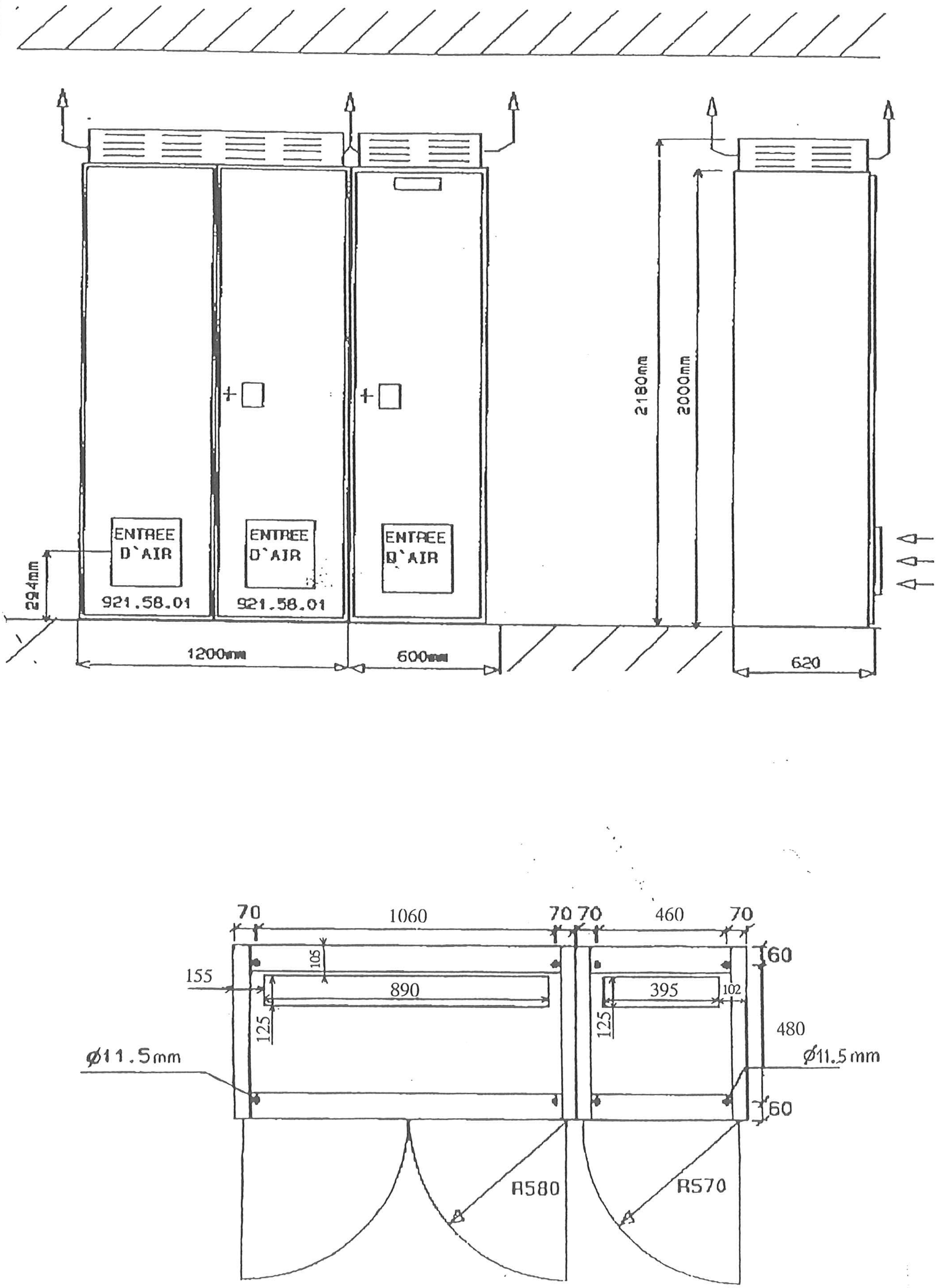
DATA	UNIT	VALUE
Variable frequency drive type	-	3 VCI S 305 Digital, field oriented vector controlled frequency converter (PWM)
Rated input voltage	V	380
Input voltage variation	%	± 10
Input frequency	Hz	50
Input frequency variation	Hz	48 - 62
Speed range	rpm	295/2950
Speed accuracy	%	0,1
Output frequency range	Hz	0,5 - 240
Maximum output current	A	305
Power factor		> 0,95
Efficiency	%	> 96
Degree of protection	-	IP 20
Cooling system	-	Air forced
Air flow	m3/h	2850

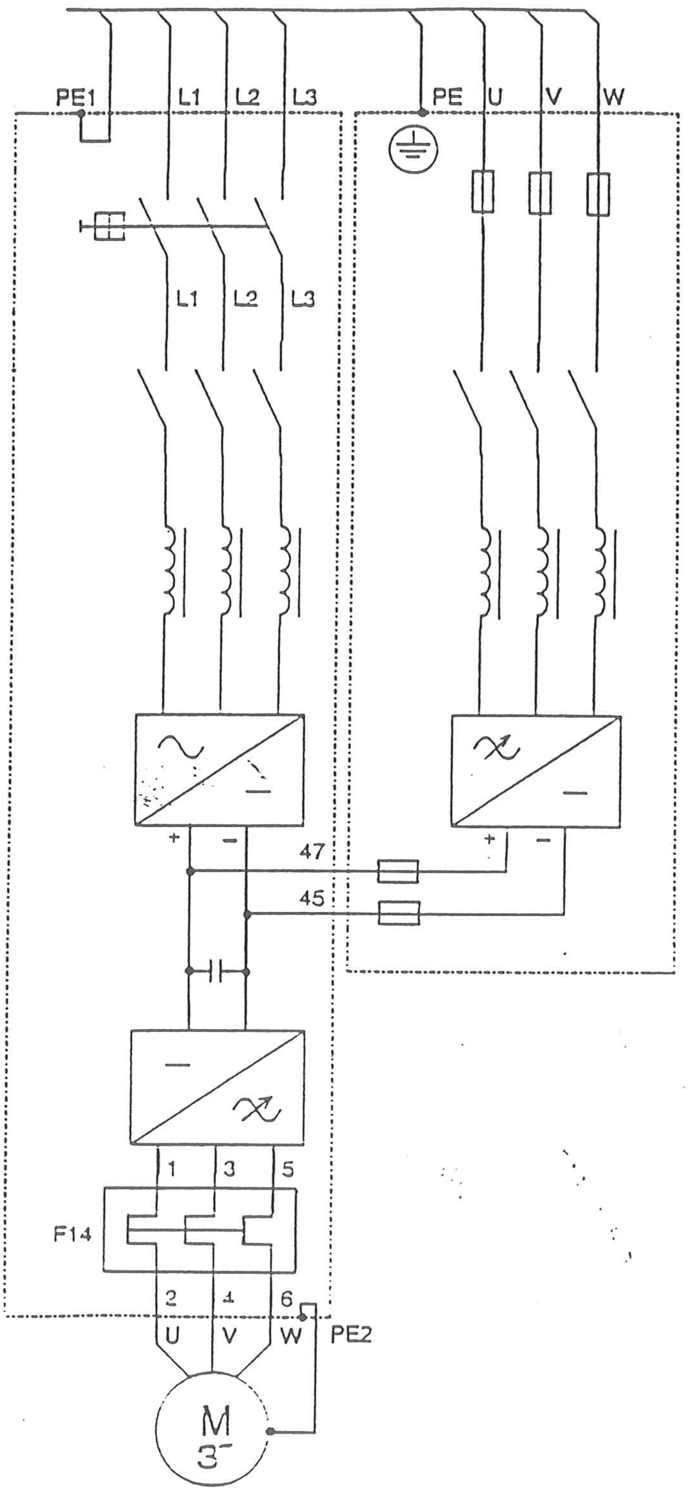
ID 09/91

4.2 MOTOR

DATA	UNIT	VALUE
Nominal power	KW	145
Speed	rpm	2950
Efficiency	%	87
Power supply	V	380
Frequency	Hz	50
Coupling	-	△
Current	A	275
Nominal torque	mN	468

Converter Outline Drawing





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A
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JEUMONT SCHNEIDER INDUSTRIE

date d'édition 02/11/92

de Commande : i88037

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Page :

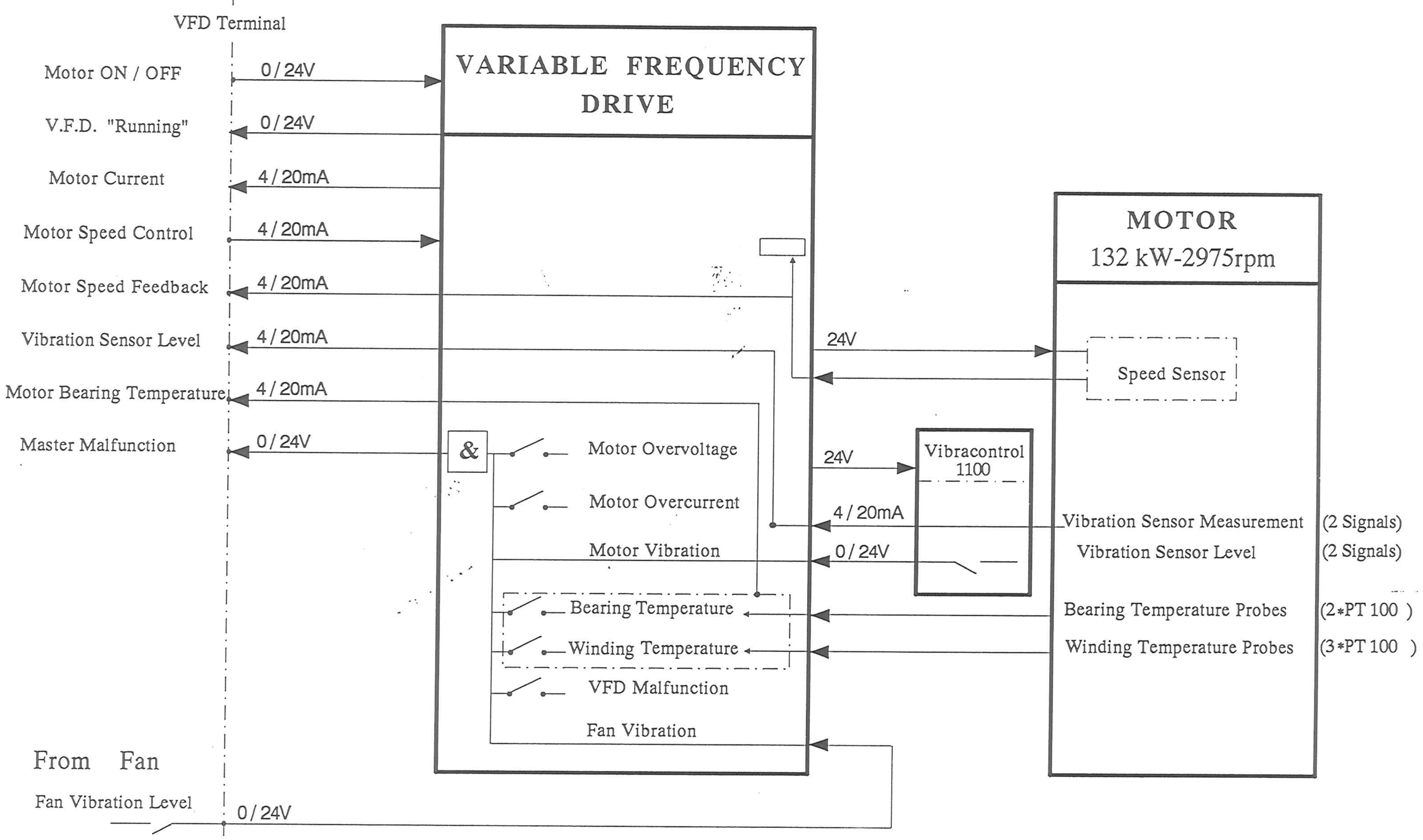
Indices

Client :

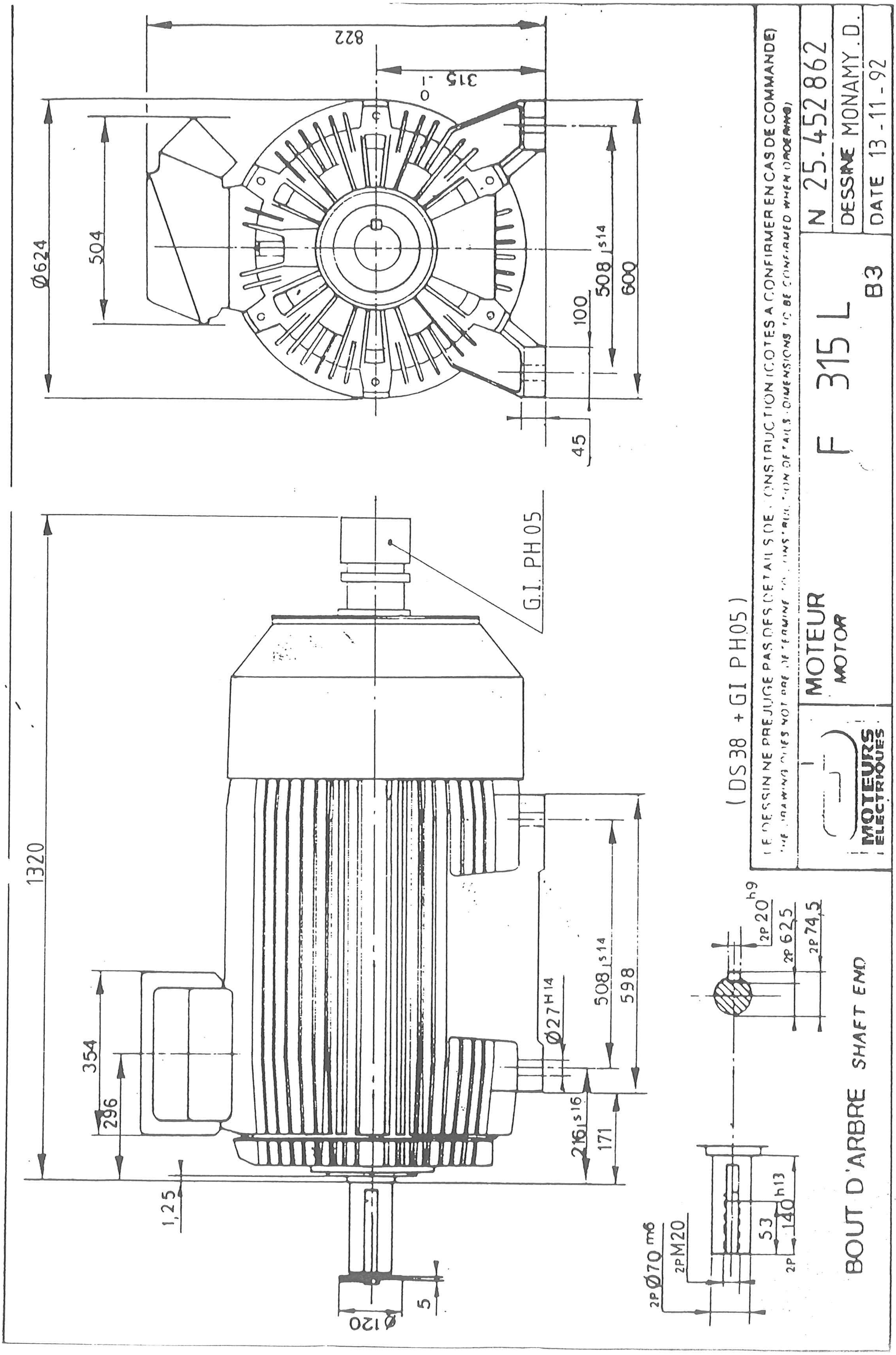
CIRA . PT1

Electrical Diagram.

PT1 DRIVE, MOTOR AND 'D INTERFACES

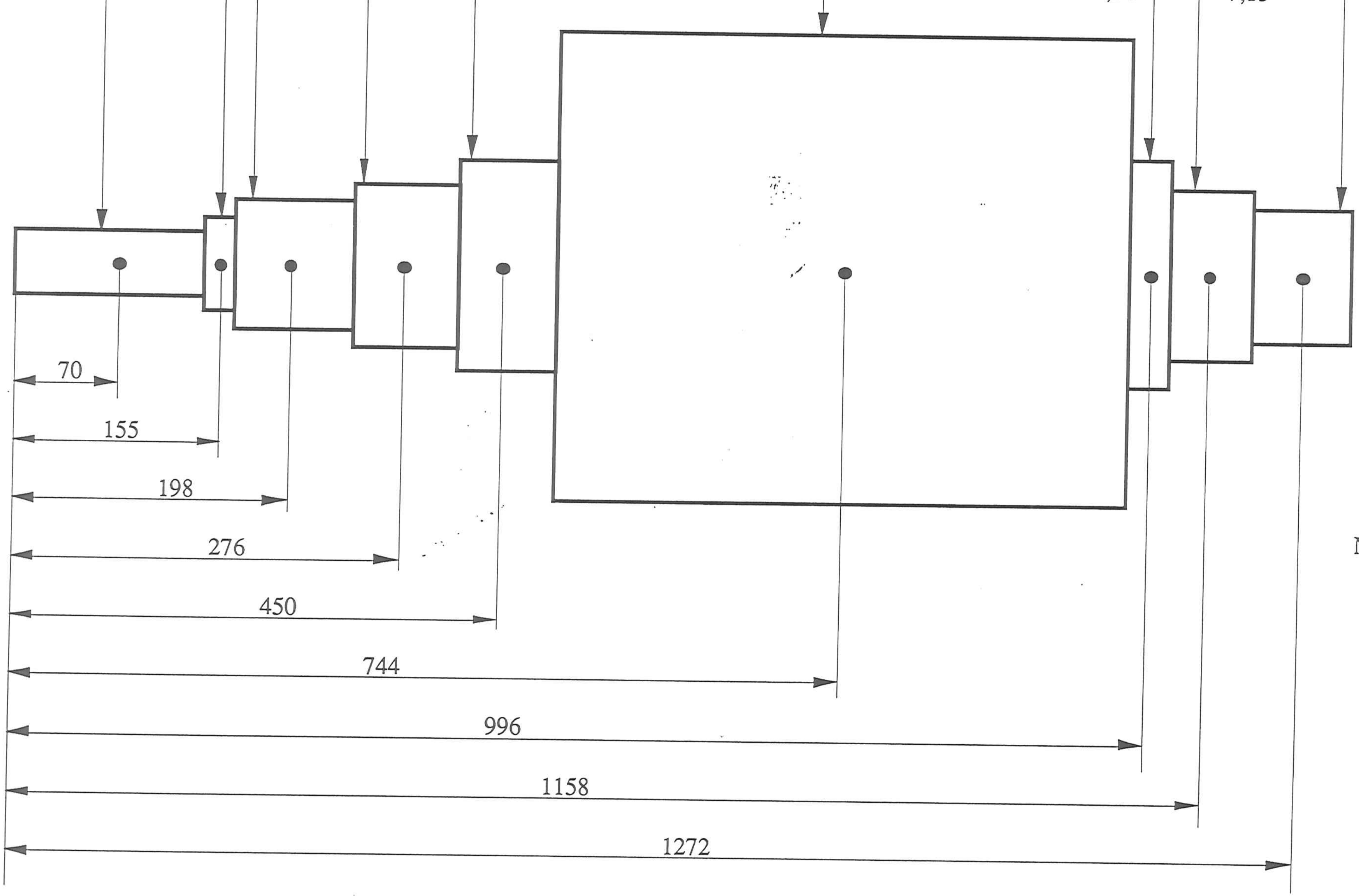


Aff.: 188037 Indice:3


LE DESSIN NE PREJUGE PAS DES DETAILS DE CONSTRUCTION (COTES A CONFIRMER EN CAS DE COMMANDE)
(DS 38 + GI PH05)
MOTEURS ELECTRIQUES
MOTEUR
MOTOR
F 315 L
B3
N 25.452862
DESSINE MONAMY. D.
DATE 13-11-92
BOUT D'ARBRE SHAFT END
G.I. PH05
822
315
Ø624
504
508 js14
600
100
45
1320
354
296
1,25
598
Ø27 H14
216 js16
171
Ø120
5
2P Ø70 m6
2P M20
53
2P 140 h13
2P 20 h9
2P 62,5
2P 74,5

CONSTRUCTIONS ELECTRIQUES DE BEAUCOURT	MOTEUR TYPE: F 315L 2POLES 145KW AR 995102/00	Etabli par: BIDEAUX J le 16-11-92

Lg	140	30	56	100	248	340	164	160	67
Ø	70	80	85	108	110	276,2	120	85	60
Masses	4,23	1,18	2,49	7,19	18,50	156,86	14,56	7,13	1,49



Masse totale (kg): 213,63

PD2 kgm2: 6,29

J kgm2: 1,57

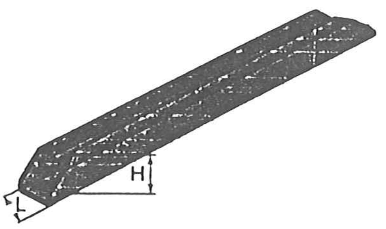
MATIERE : ARBRE XC38

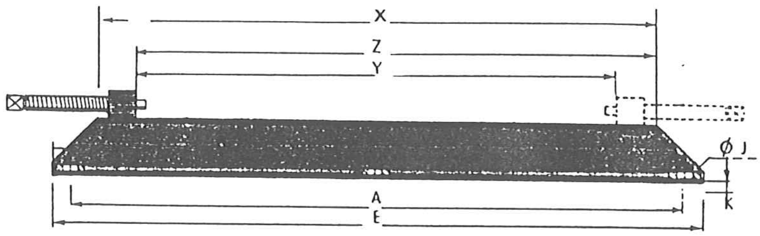
GLISSIÈRES NORMALISÉES

Conformes à la norme UTE C 51-106

NORMSPANNSCHIENEN

Nach UTE C51-106





NOTA : ces glissières en acier sont fournies sans boulons de scellement.

NOTA : Diese Spannschienen aus Stahl sind ohne Befestigungschraube geliefert.

DIMENSIONS EN MM - MASSE IN MM

HAUTEUR D'AXE MOTEUR	GLISSIÈRES TYPES	ENCOMBREMENTS A	E	H	K	L	X	Y	Z	ϕ J	POIDS PAR PAIRE DE GLISSIÈRES (kg)
SHAFT HEIGHT MOTOR	SLIDE RAILS FRAMES	PRINCIPAL DIMENSIONS A	E	H	K	L	X	Y	Z	ϕ J	WEIGHT FOR BOTH RAILS (kg)
BAUGRÖßE MOTOR	SPANNSCHIENEN - TYPEN	ABMESSUNGEN A	E	H	K	L	X	Y	Z	ϕ J	GEWICHT FÜR BEIDE SPANNSCHIENEN (kg)
56 63 71	G 71/5 PM	280	312	28	1,5	40,2	262	206	324	10,5	1,12
80 90	G 90/8 PM	355	395	40	2,5	50	324	264	294	13	2,97
100 112 132	G 132/10 PM	480	530	49,5	7	60	442	368	405	15	6,10
160 180	G 180/12 PM	630	686	60,5	7	75	575	475	525	19	10,65
200 225	G 225/16 PF	800	864	75	28,5	90	–	623	698	24	16,20
250 280	G 280/20 PF	1000	1072	100	35	112	–	764	864	30	36,10
315 / 355	F 355/24 PF	1250	1330	125	36	130	–	946	1064	30	59,50

CONSTRUCTIONS
ELECTRIQUES
DE BEAUCOURT

BP 2 - 90500 BEAUCOURT

ASYNCHRONOUS THREEPHASE MOTORS
Operating and maintenance instructions

-=-=-=-=-=-

STARTING - U P

Before starting-up time, the motor must be stored in a dry and clean place, and protected against blows and vibrations.

STORAGE

Even if this last condition can not be fulfilled it is, however, necessary to place the unit as shipped in its utilization position under a shelter even improvised (tarpaulin or sheet metal) ; by shipped it is understood packing gland or cable inlet covered, terminal box tightly closed and, if applicable, blanking plates fitted to used grease outlets and drain holes, il any, fitted with plugs.

Check rust proofing of unpainted areas for good condition.

NOTE :

The horinzontal axis motors usually comprise :

- 2 drain holes

For shipment these drain holes are fitted with studs.

If the storage time is to be long, the rotor shall be rotated a fraction of a turn every 15 days.

BEFORE INSTALLATION

Carefully clean the motor and remove using thinners and not abrasive paper the rust proofing applied to shaft end and possibly the clamp, then if fitted, remove the shipment locking device of the rotor then evacuate all condensated water caused by drew from inside the motor.

It is not necessary to refit the plugs except :
- If the motor is placed in a position different from its utilization position,
- If the motor is exposed to running or splashed water.

Then check that :
- the motor turns by hand in order to check any damage caused during transport,
- the windings are not humid. To scheck this, measure stator and rotor winding insulation resistance.

Resistance must not be less 1000 ohms per operation volt (i.e. 0,38 MΩ for a 380 V motor). A value as low as this is considered as being an indication of abnormal humidity.
Under 5 MΩ the winding must be dried.

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Drying is to be performed in an oven (80 to 100° C) or by a reduced voltage supply of 0,1 or 0,2 of nominal voltage. All openings (cover, terminal box, drain holes, etc.) must be free.
Otherwise, simply let the motor turn over with no load and ventilation blanked for a few hours.

INSTALLATION

The motor shall be mounted on a rigid base so to avoid all deformations and vibrations.

The ventilation inlets and outlets shall be thoroughly freed to allow cooling air to circulate freely; make sure that this air is not recycled.

Provide easy access to terminals and, as the case may be, to lubricators, drain plugs, and commutator inspection doors.

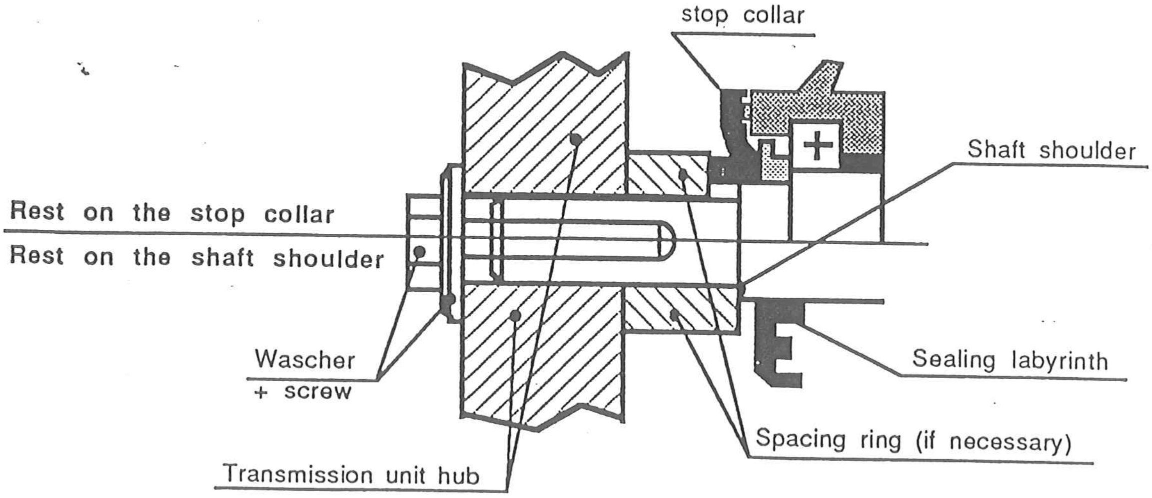
TRANSMISSION UNIT ASSEMBLY

The following concerns keys cylindrical shaft ends.

Ask us for special instructions in the case of taper or smooth cylindrical shaft ends for hot-mounting of transmission unit.

Pulleys, pinions, coupling sleeves, perfectly balanced (in compliance with regulation in force, our motor rotors are balanced with a whole key) must be mounted on the motor shaft end.
1°) By avoiding blows which can damage bearings. To this end, use a screw device and the tapped hole of the shaft end. The use of a special lubricant (for example Molykote) can be advisable.
2°) By complying strictly with the instructions of the supplier concerned, and especially with the bore clearance and key adjustment requirements.

It is essential that the transmission unit hub :
- on one hand, rests on the shaft shoulder or, in its absence, on the metal stop-collar acting as sealing disc and used to lock the bearing,
- on the other hand, is 2 to 3 mm longer than the sheft end to ensure screw and washer tightening of the shaft end. If necessary, insert a spacing ring of adequate length.



Then ckeck that the motor can be rotated manually. Several complementary checkings are necessary in each case, to avoid bearing stress.

PULLEY TRANSMISSION

Make sure that transmission by pulley is possible (some motors can only use direct coupling) and that the pulley dimensions are adequate.
Generally the pulley diameter must be greater than the motor axis height.

Driving and receiving pulleys shall be lined up, their axis parallel, with sufficient distance between centres. We advise the slide installation which allows perfect alignment and maximum adjustment of belt tension (tensed to avoid sliding).

CONNECTING UP

We recommend the use of a protection device, against overloads or single-phase operation.

The coupling made to be used according to network voltage can be checked by consulting :

- the diagram glued on the terminal box cover
- or the name-plate diagram

A connection mistake can in some cases (star instead of delta connection with small load) only cause considerable temperature rises in the rotor (without starting up the protection device), leading to bearing or winding damage.

The strips necessary to the connection are either placed on the terminals, or in a separate bag inside the terminal box.

Connecting up is carried out by using cables sufficiently sized to reduce voltage drops, and with an outer diameter corresponding to compression gland sizes. Earth the motor. A screw is provided for this purpose inside the box, which allows the connection of an earth lead or of the metallic sheath of the cable.

Never touch motor internal connections.

In the case of ring wound putting under voltage, make sure that the lugs are well positioned and that the nuts and counter-nuts are correctly tightened.

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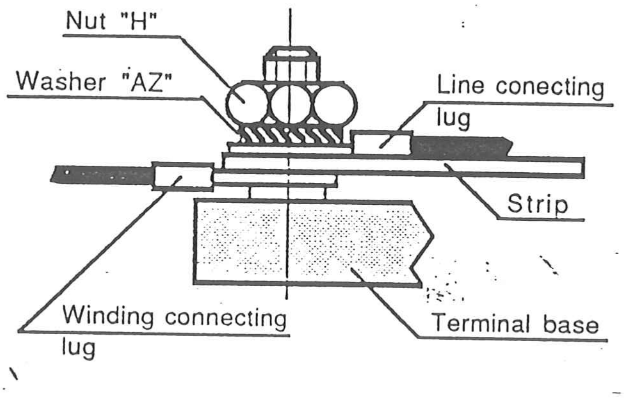
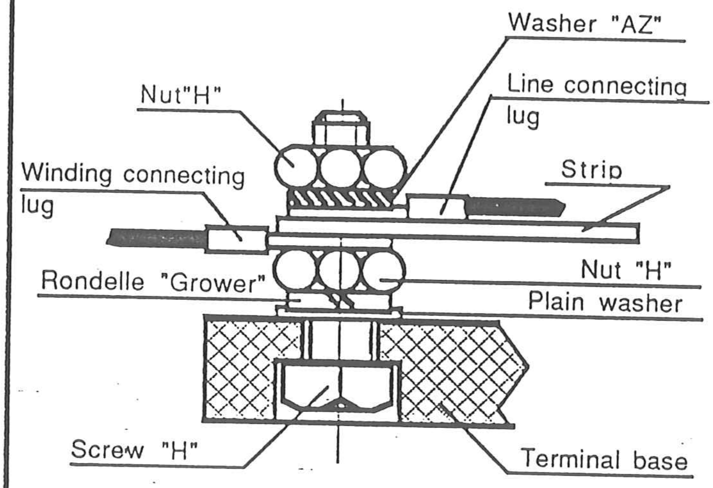
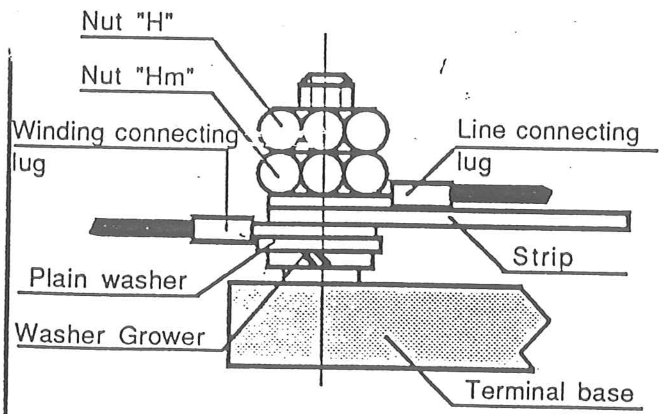
CONNECTING UP

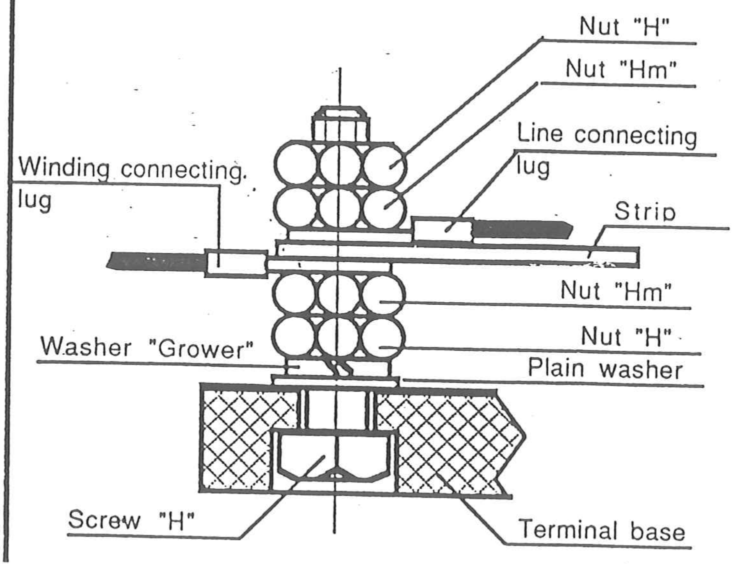
MOULDED BASE WITH TERMINALS



TERMINAL FITTED TO THE BASE







The thermal protection devices and the heating resistance, if any, are brought back to the terminal box.

To inverse rotation direction :
- with three-phase current, cross 2 line wires

MAINTENANCE

Keep the motor clean so as to avoid impeding cooling. Make sure that air passages are not obturated.

PERIODICAL CHECKS

According to the cases open regularly the drain holes.

On slip-ring rotor motors, every 1000 hours, check commutator area. Rings must be cleaned, free of grease, smooth, and present no grits. In case of commutator clogging, clean with a cloth soaked in petrol.

Make sure that the brushes :

- slide freely in their housings
- rest evenly on the rings
- present no abnormal wear

If the brushes are too used, replace them with new brushes, identical in number and quality to the original ones, the carrying surface of which shall be abraded.
To this effect :

- Increase the curve before inserting the brushes in the brush-holders,
- Continue with a fine emery cloth wound on the rings,
- Complete the operation by using very fine sand paper in the normal direction of rotation.

After grounding, make sure that no abrasive grits remain on brush surfaces, and clean carefully.

It is strongly recommanded to frequently blow dry compressed air in the machine to remove carbon dust from housings, brush-holders, commutator and windings. Insulating parts must be wiped with a clean cloth.

Rotating motor : check that there is no flash under the brushes.

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LUBRICATION

With the exception of life-lubricated bearings, equipping the lower voltage range motors (which do not comprise lubricators), all bearings must periodically be re-lubricated.

The time intervals between 2 successive lubrications depend on the rotating speed of the motor, on the type and size of the bearing, on the motor utilisation factor and on the ambient temperature. The table page 7/8 gives lubricating instructions for general average conditions :

It is to be remembered that excessive lubrication can lead to considerable bearing température rises. The interval between two lubrications must never exceed one year, even if the normal time limit is not reached, due to the conditions of use.

We also recommend lubrication after a prolonged standstill of the motor (greater than or equal to 6 months) before restarting.

It is advised to carry out the above lubrication operations with the motor running, if possible by means of the directed lubrication nipples comprised in our motors; in the higher voltage range, they also comprise a spent grease outlet (grease valve).

The spent grease outlets are obturated on some motors to avoid dust penetration. After ten lubrications, it is necessary to remove the corresponding plugs to eliminate spent grease.

This operation may require the removal of the fan protection cover.

In a normal, non dusty atmosphere, these plates can be removed permanently, at least for motors operating in a horizontal position.

LEROY SOMER

FICHE TECHNIQUE MOTEUR (B)
BREA SERIES MOTOR SPECIFICATION
TYPE : 315 L2

Moteur asynchrone triphasé, rotor à cage, fermé à enveloppe fonte, exécution standard
Three phase asynchronous motor, squirrel cage, totally enclosed, cast iron casing, standard execution
Formes de construction possibles : axe horizontal (position B3 ou B35) ou vertical (position V1)
Frame choice : horizontal (B3 or B35 position) or vertical axis (V1 position)
Degré de protection standard : IP 55
Standard level of protection : IP 55
Isolation : classe F - Echauffement : classe B - Ambiante 40°C
Insulation : class F - Temperature rise : class B - Ambiant 40°C

CARACTERISTIQUES ELECTRIQUES *(ELECTRICAL SPECIFICATIONS)*

		2/4	3/4	4/4
Puissance - *Power* -(kW)		73	109	145
Vitesse - *Speed* (tr/mn)				2 950
Rendement - *Efficiency* (%)		91	92	93
Cosinus Ø - *Power factor*		0,80	0,83	0,87
Tension d'alimentation - *Power supply* (V - 50Hz)	380			
Couplage - *Coupling*	Δ			
Intensité - *Current* (A)		152	217	275
ID/IN - *SC/FLC*	7			
Couple nominal - *Nominal torque* (mN)		236	352	468
CD/CN - *ST/FLT*	1,6			
Cmax/CN - *Max T/FLT*	2,5			
Constante thermique - *Thermical constant* (mn)	38			
Temps rotor bloqué - *Locked rotor time* (s)	10			

CARACTERISTIQUES MECANIQUES *(MECHANICAL SPECIFICATIONS)*

	Moteur horizontal *Horizontal motor*	Moteur vertical *Vertical motor*
Roulement côté entraînement -*Drive end bearing*	6317 C3	N 317 C3
Intervalle de graissage - *Lubrication period* (H)	1 700	850
Quantité de graisse - *Volume of grease* (cm3)	37	37
Roulement côté opposé - *N.D.E. bearing*	6317 C3	7317 B
Intervalle de graissage - *Lubrication period* (H)	1 700	1 700
Quantité de graisse - *Volume of grease* (cm3)	37	37
Qualité de la graisse - *Quality of grease*	ESSO UNIREX N3	ESSO UNIREX N3
Force radiale admissible - *Admissible radial strength* (daN)	588	642
Force axiale admissible - *Admissible axial strength* (daN)	300	↓ 231 ↑ 462
Bruit - *Noise* (dBA)	85	85
Inertie du rotor - *Rotor inertia* - J - (kgm2)	1,57	2,15
Masse - *Mass* (kg)	1 050	1 050

FICHE N° - *DATA SHEET Nb* : F>315 L2-145-380Δ

CONSTRUCTIONS ELECTRIQUES DE BEAUCOURT

BP 2 - 90500 BEAUCOURT

MOTOR H / V	POLARITY	TYPE	POSITION OF BEARINGS	BEARINGS	LUBRICATION	GREASE QT. BY BEARING (CM3)	INTERV. IN HOURS X 1000 2 P	4 P	6 P	8 P
HORIZONTAL & VERTICAL	ALL POLARITIES	80L	D.E. BEARING	6204 2RS	Life lub.	-	-	-	-	-
			N.D.E. BEARING	6203 2RS	Life lub.	-	-	-	-	-
		90SL	D.E. BEARING	6205 2RS	Life lub.	-	-	-	-	-
			N.D.E. BEARING	6204 2RS	Life lub.	-	-	-	-	-
		100L	D.E. BEARING	6206 2RS	Life lub.	-	-	-	-	-
			N.D.E. BEARING	6205 2RS	Life lub.	-	-	-	-	-
		112M	D.E. BEARING	6206 2RS	Life lub.	-	-	-	-	-
			N.D.E. BEARING	6205 2RS	Life lub.	-	-	-	-	-
		132SM	D.E. BEARING	6308 2RS	Life lub.	-	-	-	-	-
			N.D.E. BEARING	6207 2RS	Life lub.	-	-	-	-	-
		160ML	D.E. BEARING	6309 C3	Esso Unirex N3	13	5.2	12	19	26
			N.D.E. BEARING	6210 C3	" Unirex N3	10	4.6	11	18	24
		180ML	D.E. BEARING	6310 C3	" Unirex N3	15	4.6	11	18	24
			N.D.E. BEARING	6310 C3	" Unirex N3	15	4.6	11	18	24
		200L	D.E. BEARING	6312 C3	" Unirex N3	20	3.6	9.7	16	22
			N.D.E. BEARING	6312 C3	" Unirex N3	20	3.6	9.7	16	22
		225SM	D.E. BEARING	6314 C3	" Unirex N3	26	2.8	8.3	14	20
			N.D.E. BEARING	6216 C3	" Unirex N3	18	2	7.2	12.5	18
		250M	D.E. BEARING	6314 C3	" Unirex N3	26	2.8	8.3	14	20
			N.D.E. BEARING	6216 C3	" Unirex N3	18	2	7.2	12.5	18
	2 POLES	280SM	D.E. BEARING	6219 C3	" Unirex N3	28	1	-	-	-
			N.D.E. BEARING	6219 C3	" Unirex N3	28	1	-	-	-
	4 POLES & +	280SM	D.E. BEARING	6318 C3	" Unirex N3	40	-	6.2	11	16
			N.D.E. BEARING	6219 C3	" Unirex N3	28	-	5.8	10.5	15.5
	2 POLES	315S	D.E. BEARING	6219 C3	" Unirex N3	28	1	-	-	-
			N.D.E. BEARING	6219 C3	" Unirex N3	28	1	-	-	-
	4 POLES & +	315S	D.E. BEARING	6318 C3	" Unirex N3	40	-	6.2	11	16
			N.D.E. BEARING	6219 C3	" Unirex N3	28	-	5.8	10.5	15.5
	2 POLES	315ML	D.E. BEARING	6317 C3	" Unirex N3	37	1.7	-	-	-
			N.D.E. BEARING	6317 C3	" Unirex N3	37	1.7	-	-	-
HORIZ	4 POLES & +	315ML	D.E. BEARING	22220 C3	" Unirex N3	42	-	0.54	1	1.47
			N.D.E. BEARING	6220 C3	" Unirex N3	31	-	5.4	10	14.5
	2 POLES	355L	D.E. BEARING	6317 C3	" Unirex N3	37	1.7	-	-	-
			N.D.E. BEARING	6317 C3	" Unirex N3	37	1.7	-	-	-
	4 POLES & +	355L	D.E. BEARING	22222 C3	" Unirex N3	53	-	0,46	0,9	13,5
			N.D.E. BEARING	NU 2222 C3	" Unirex N3	53	-	2,3	4,5	6,75
VERT	4 POLES & +	315ML	D.E. BEARING	NU 2220 C3	" Unirex N3	41	-	2,7	5	7,3
			N.D.E. BEARING	7220 B	" Unirex N3	31	-	5,4	10	14,5
	2 POLES	355L	D.E. BEARING	6317 C3	" Unirex N3	37	1.7	-	-	-
			N.D.E. BEARING	6317 C3	" Unirex N3	37	1.7	-	-	-
	4 POLES & +	355L	D.E. BEARING	NU 2222 C3	" Unirex N3	53	-	2,3	4,5	6,75
			N.D.E. BEARING	7222 B	" Unirex N3	38	-	4,5	9	13,5

LUBRICATION TIMES GIVEN FOR SPEEDS IN 2,4,6 &8 POLES UNDER 50HZ.
GREASE QUANTITIES ARE ALL GIVEN FOR ONE BEARING.

FB/249-7/8

CONSTRUCTIONS
ELECTRIQUES
DE BEAUCOURT

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LUBRICANT QUALITY

The bearings are coated, in the plant, with the quality of lubricant shown in the table hereunder, and we recommend its use for the following lubrications. Avoid mixtures. Consequently, in the case where an equivalent lubricant of different brand or grade is used,it is advised to change the bearings and clean the accessories with petrol, to remove the old lubricante before injecting the new one.

In motors comprising grease valves, the change and the cleaning operations are not necessary since the old lubricant can be drained by pumping in the new one.

When lubricating check the sealing devices :

a/ Usually the baffled sealing devices require no special supersion. If possible keep them well greased.
b/ The friction sealing devices must be inspected at regular intervals. Theys must be replaced as soon as they show signs of wear.
With references to the above :
.If the felt rings have slightly hardened they can be re-used after they have been reinpregnated for half an hour in a bath of hot oil (80-85° C) made up of 2/3 rds. cylinder oil and 1/3 rd. tallow.
.The rubber lip seals must be left for several hours in a luke warm oil bath before assembly. Then in order to avoid premeture lip wear the space at the back of the seal is fully filled up with grease after the seal has been fitted to the bearing.

Lastly during assembly care is taken to avoid damaging the seals when passing over keyways or stepped bearing surfaces of the shaft.

BEARING CHECKS

The frequency of these checks depends on the operating conditions.

If a bearing runs hot, even when correctly mounted and lubricated, makes an abnormal noise or shows considerable radial play :

It is wornand needs to be replaced as quickly as possible to avoid seizing and all the resulting consequences for the motor and the driven parts.

To dismount a bearing in the best conditions for replacement, the different parts should be marked to avoid mistakes or inversions.

Bearings are removed with extractors. To put a bearing into place:

- heat it in an oil bath at 80° C
- mount it rapidly by pushing it in to its final position.

After each replacement operation, all labyrinth and seal intervals must be filled with grease to prevent dust penetration.

SPARE PARTS

An extensive network of service agencies can supply the necassy parts rapidly.

In order to avoid all errors, it is necessary to specify the name-plate indications, and mainly the type and number of the machine as well as the reference of the part on the list.