

TVM / KDV AC Power Supplies and the KDR Regenerative Power Module

Precision Control For Automation

- **300 Vdc Bus Supply for Multiple Servo/Spindle Amplifiers**
- **Provides Regulated Control Voltages to All Drives**
- **Stores or Dissipates Regenerative Energy**
- **System and Internal Diagnostic Function Monitoring**
- **Maintenance-free Modular Design**

Description

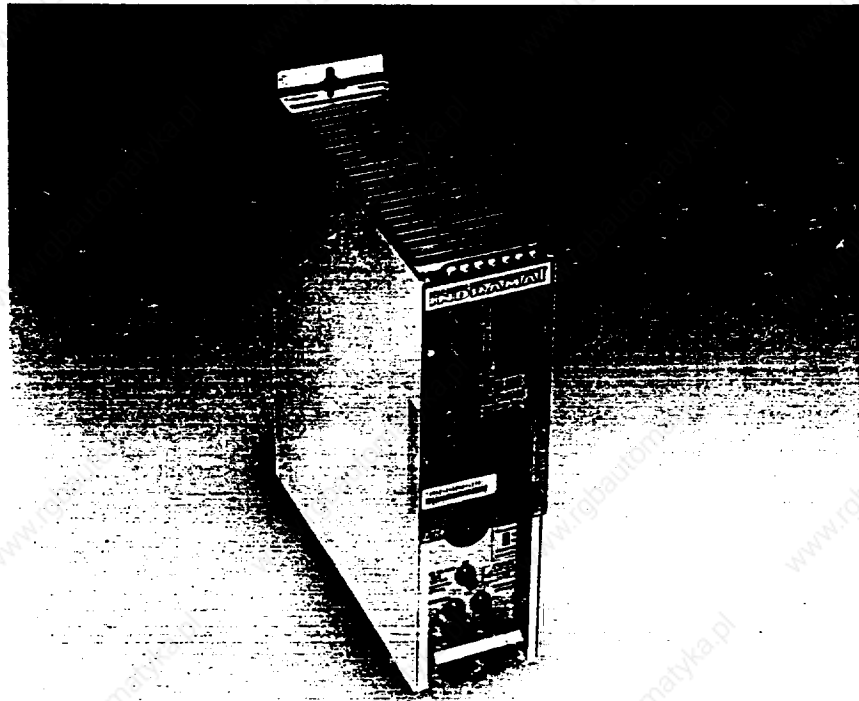
The TVM and KDV Power Supplies convert 220 Vac three phase incoming power to a 300 Vdc bus voltage which powers the Indramat AC spindle and AC servo amplifier families. The TVM and KDV supply the continuous and peak drive energy for up to 6 spindle or axis amplifiers from one main power bus. The 300 Vdc bus design allows the TVM and KDV to power high horsepower applications while losing less power to heat. They also supply all the regulated control voltages required by the spindle or servo amplifiers. These power supplies are engineered to provide complete multiple servo/spindle system power along with the system safeguards to ensure reliable operation in the most demanding applications.

TVM Power Supply

The TVM is a one-piece modular unit made to quickly interconnect to modules such as the TDM servo amplifier and TWM high performance spindle drive and is designed for easy mounting in a control cabinet.

The TVM features fusing for main bus power and control voltages for complete power supply protection. All fuses are easily accessed at the front panel. The 300 Vdc bus is monitored for over-voltage and

under-voltage conditions. The TVM power supply's interconnection design ensures that the 300 Vdc bus is not energized until all of the connected amplifiers return a System Ready signal.



TVM Power Supply

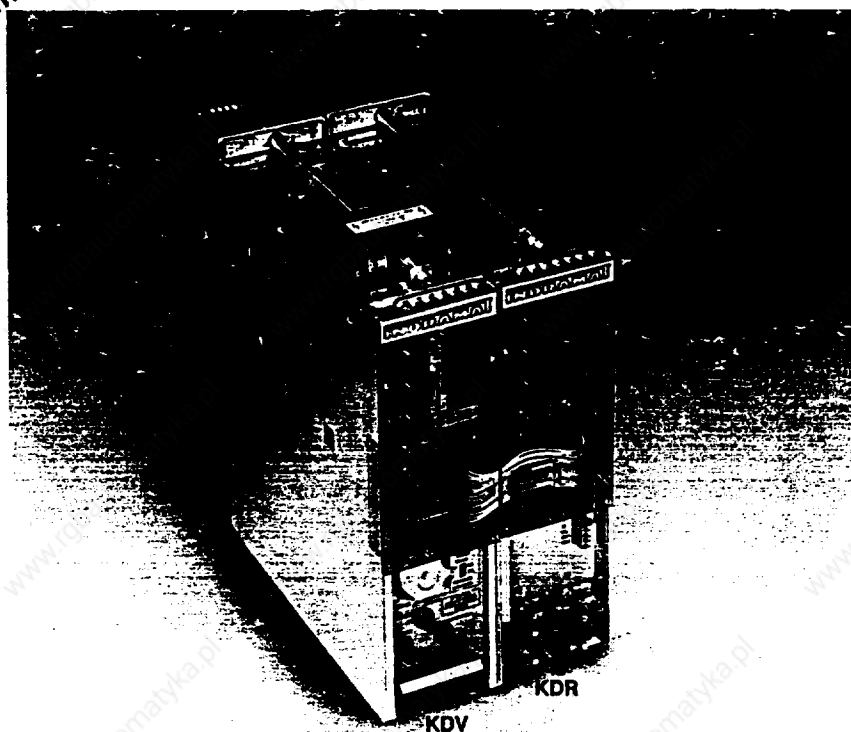
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FIG. 6D-1

KDV Power Supply

Indramat's KDV series is the "cold module" version of the TVM. The KDV series includes all the features of the TVM, but also features an external heat sink which allows it to handle more continuous power and to dissipate regenerative energy outside the cabinet. The main power handling components are mounted on a heat sink that extends through a cutout in the electrical cabinet, conducting heat out of the cabinet. Thus, compared to the TVM, the KDV delivers higher peak and continuous power output levels, yet allows smaller electrical cabinets to be used. An integral gasket seal protects the electronic components from outside contaminants while maintaining the sealed integrity of the control cabinet.

The KDR Regenerative Power Module can be used with a KDV to return regenerated energy to the power lines.



KDV Power Supply and KDR Regenerative Power Module

Applications

The TVM and KDV AC Power Supplies are designed for use with the Indramat family of brushless AC servo and spindle drives including:

Product	Function	Application
TDM/KDS	Brushless AC Servo Amplifiers	High performance servo drives
KDF	Variable Frequency Drive (Open-loop)	General purpose induction motor drive
KDA/CDM	Induction Motor Spindle Drive (Closed-loop)	High performance vector controlled spindle drive for induction motors
KDA 2	Induction Motor Spindle Drive (Closed-loop)	High performance vector controlled spindle drive for induction motors
TWM/KDW	Brushless AC Spindle Drive	High performance spindle drives for MAC AC permanent magnet spindle motors

Advantages

- Diagnostic and internal function monitoring.
- Factory full-power testing and conservative ratings ensure dependable and reliable service.
- TVM/KDV energizes 300 Vdc bus only after System Ready signal is received from all interconnected drives.
- Precision components, such as low-drift op-amps and metal film resistors, are used in all critical areas of the design.
- All power supplies feature fault monitoring, including over-voltage and under-voltage monitoring. All fault circuitry in a multi-module system is interconnected for maximum system protection.
- Power supplies are engineered for easy mounting and interconnection in multiple-axis systems.

Design Features

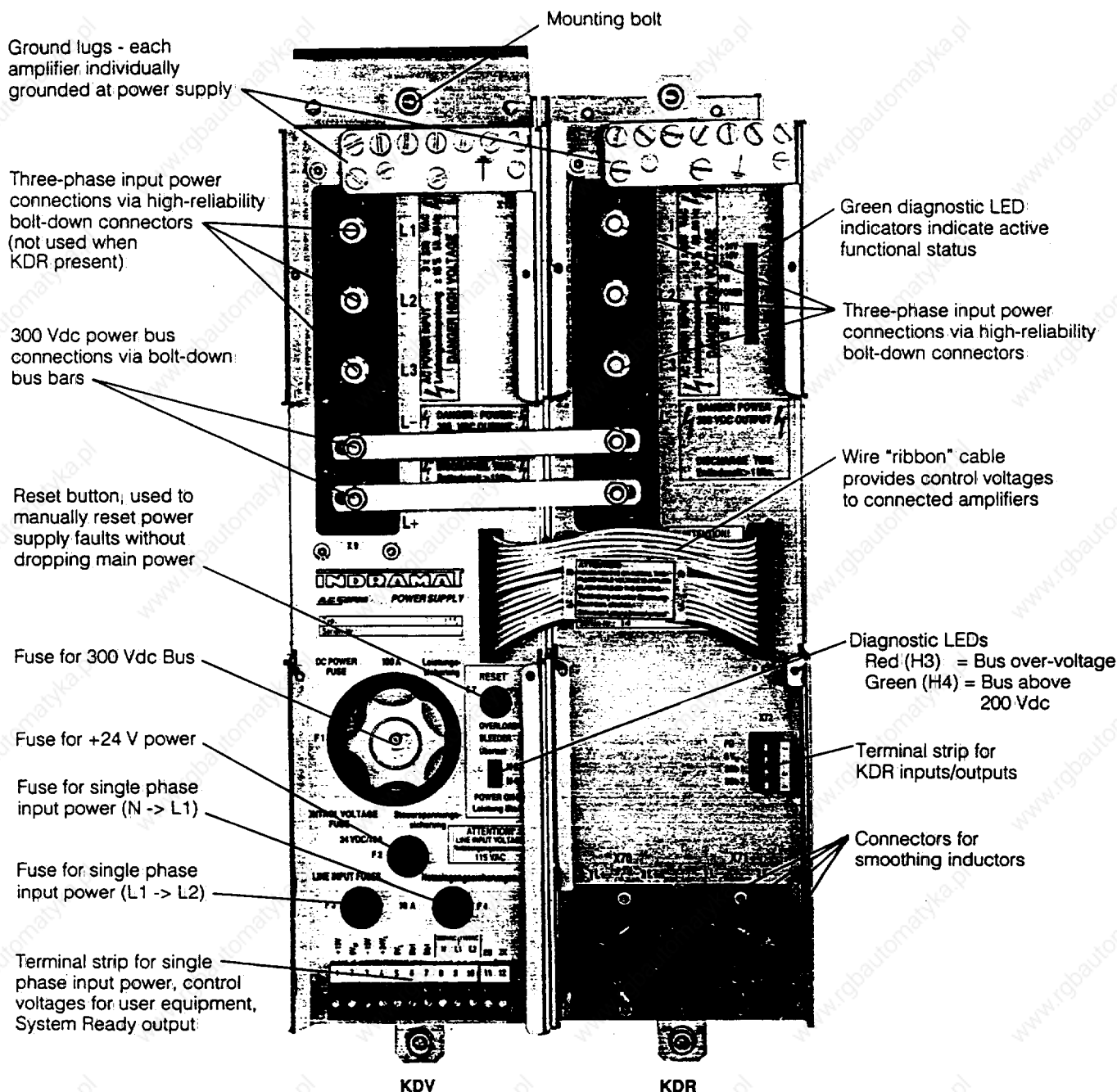
Indramat's modular packaging means easy installation and simple, accessible electrical connections. The TVM or KDV can be mounted in any control cabinet that is about 16 inches deep, powering a combination of up to six amplifiers or spindle drives.

Diagnostic Features

TVM and KDV diagnostics and LED indicators provide instant information for troubleshooting and rapid replacement if a failure should occur. Internal functions are monitored, such as: bus over-voltage and under-voltage, bleeder circuit operation time and amplifier-to-amplifier system status. A System

ready contact closure output is provided to the user's CNC control to indicate that all monitored conditions are satisfactory and the power supply is operational.

A green LED indicates bus power is on. A red LED indicates that the bleeder resistor has reached its temperature limit and a bus over-voltage condition exists.



Note: KDV Power Supply with optional KDR Regenerative Power Module is shown. TVM features are similar to KDV.

Note: Shown without plastic shield which covers high voltage connections.

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FIG. 6D - 3

Regenerative Energy Handling

Regenerative energy is developed when a moving mass (e.g., spindle or slide) is slowed or stopped, causing the motor to act as a generator. This regenerative energy is returned to the power supply, raising the bus voltage, possibly to destructive levels.

Indramat's TVM and KDV power supply design prevents amplifier and power supply damage due to moderate levels of regenerative energy. They monitor the output bus voltage and store regenerated energy in capacitors for use in the next acceleration or drain off excess power as heat through bleeder power resistors.

The TVM can handle higher levels of regenerative energy by adding the optional TBM Bleeder Module or TCM Capacitance Module to the drive system. The KDV can handle higher regenerative energy by adding the optional KDR Regenerative Power Module to return regenerative energy to the power lines.

TBM Bleeder Module

The TBM Bleeder Module is used in applications where regenerative energy is returned in excess of the rated bleeder capacity of the TVM power supply. The TBM's power resistors dissipate regenerative power as heat while clamping the maximum bus voltage during deceleration and braking to protect the connected amplifiers from damage.

TCM Capacitor Module

The TCM Capacitor Module (or external capacitors) is used with the TVM or KDV in short duty cycle applications with frequent starts and stops. The TCM module stores the regenerative energy returned to the power supply, making it available for use on the next acceleration.

KDR Regenerative Power Module

The KDR Regenerative Power Module is used with a KDV to return energy regenerated during deceleration and braking to the main power line.

The KDR is connected to the three phase power lines and it, rather than the KDV, maintains the 300 Vdc bus.

The KDV performs its normal function of supplying system dc control voltages, handling diagnostic functions and controlling the bleeder function (required in case of three-phase power loss).

Typical applications for the KDR are spindle drives rated at 20 kW and above with short or rapid duty cycles, and vertical servo axes which return large amounts of regenerative energy on their downward motions.

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KDR Regenerative Power Module Specifications

Maximum continuous power available on the 300 Vdc bus.	25 kW
Maximum continuous regenerated power.	13 kW
Peak regenerated power over a 1 second period.	31 kW-sec

Note: Maximum system power dissipation is 40 kW. This is the maximum power which can be dissipated by the KDV's bleeder resistor over a 1 second period (60 kW instantaneously). This is used only if three phase power is lost. In such a case, regenerated energy cannot be returned to the line and must be dissipated by the bleeder.

Bleeder Specifications

Power Supply	Continuous Bleeder Power	Peak Bleeder Power	Maximum Power Dissipation In Cabinet
	W	kW	W
TVM 1.2	300	10	400
TVM 2.1	450	10	580
KDV 1.3	2000	40	150
Power Supply with TBM Module			
TVM 1.2 w/TBM	1200	30	400
TVM 2.1 w/TBM	1350	30	580

TCM Capacitor Module Specifications

Model	Capacitance	Voltage Rating	Energy Storage
TCM 1.1-08	8000 μ F	1200 WVdc	800 Ws*

* Includes energy stored during normal operations.

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Specifications

TVM Series Power Supplies

Power Supply ¹	Continuous Output Current ²	Peak Output Current	Maximum Continuous Input Power	Bleeder	
				Peak Energy	Continuous Power
	A	A	kVA	kWs	kW
TVM 1.2- 50-220/300-W0	25	150	7.5	14	0.30
TVM 2.1- 50-220/300-W1	25	150	7.5	14	0.45
Power Supply with TBM Bleeder Module (TBM 1.1-20)³					
TVM 1.2- 50-220/300-W0	25	150	7.5	44	1.20
TVM 2.1- 50-220/300-W1	25	150	7.5	44	1.35

KDV Series Power Supplies

Power Supply ¹	Continuous Output Current ²	Peak Output Current	Maximum Continuous Input Power	Bleeder	
				Peak Energy	Continuous Power
	A	A	kVA	kWs	kW
KDV 1.3-100-220/300-W0	100	300	30	60	0.2
KDV 1.3-100-220/300-W1	100	300	30	60	2.0
Power Supply with Inductors³					
KDV 1.3-100-220/300-W0	100	300	30	60	0.2
KDV 1.3-100-220/300-W1	100	300	30	60	2.0
Power Supply with TCM Capacitor Module and Inductors³					
KDV 1.3-100-220/300-W1	100	300	30	60	2.0

Notes:

1. TVM Power Supplies — Models ending in "W0" do not have blowers. Models ending in "W1" are equipped with an internal blower.
KDV Power Supplies — All KDV power supplies have an internal blower as standard. KDV models ending in "W1" are rated for use with an external blower which blows cooling air over the heat sink. The Model LE-3 blower and shroud must be ordered separately.
2. Power supply specifications are based on 45 °C ambient temperature. Blower-cooled power supplies may be used up to an ambient of 55 °C. The continuous current rating of these power supplies must be reduced by 1% for each degree over 45 °C.
3. TBM Bleeder Modules, TCM Capacitor Modules and inductors are optional and are purchased separately.

Control Voltage (1-phase)	115/220 or 220/380 Vac	Weights	
Line Voltage (3-phase)	220 Vac $\pm$ 15%	TVM	33 lb (15.0 kg)
Frequency	50-60 Hz	KDV	45 lb (20.4 kg)
Bus Voltage	300 Vdc $\pm$ 15%	TBM	16 lb (7.3 kg)
Blower power consumption		TCM	16 lb (7.3 kg)
TVM	15 VA	KDR	35 lb (15.9 kg)
TBM	15 VA	Allowable ambient temperature range at rated specifications	5 to 45 °C (41 to 113 °F)
KDV (includes internal blower)	15 VA	Absolute maximum temperature	55 °C (131 °F) (Units with blowers only; reduce continuous current by 1% per degree above 45 °C)
KDV with optional external blower	80 VA	Storage and transportation temperature range	-30 to 85 °C (-22 to 185 °F)
Maximum operating altitude at rated specifications	1000 m (3280 ft)	Protection system	IP 10 -- Open frame module for mounting in a control cabinet

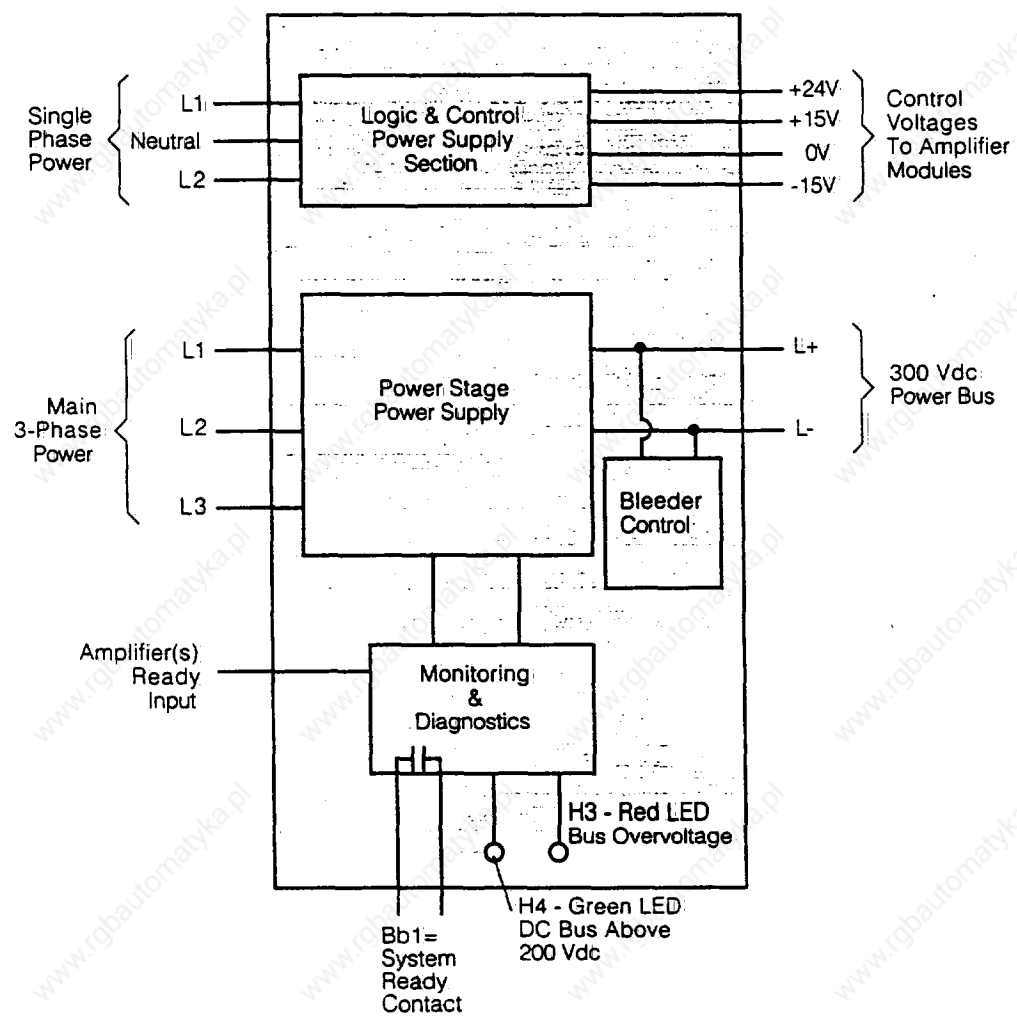
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Control Voltage Specifications

Both the TVM and KDV supply ± 15 V and +24 V control voltages to all connected modules. These voltages are also available to the user to power other devices within the electrical cabinet. The total current draw on the power supply from the connected Indramat modules plus any user devices can not exceed the values in the table to the right.

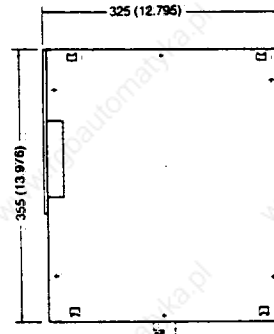
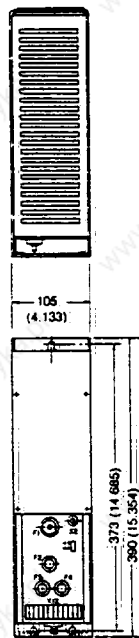
Power Supply	+15 Vdc	-15 Vdc	+24 Vdc
	mA	mA	mA
TVM 1.2	750	850	4000
TVM 2.1	900	1000	8000
KDV 1.3	1500	1200	8000

Block Diagram

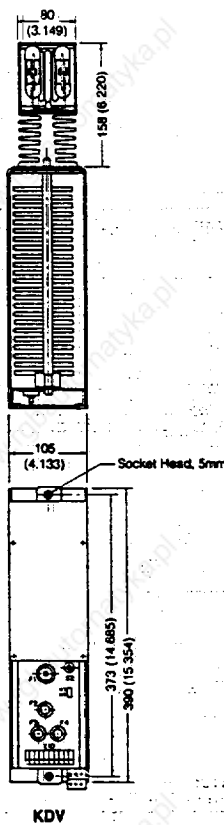


TVM Power Supply Outline Drawing

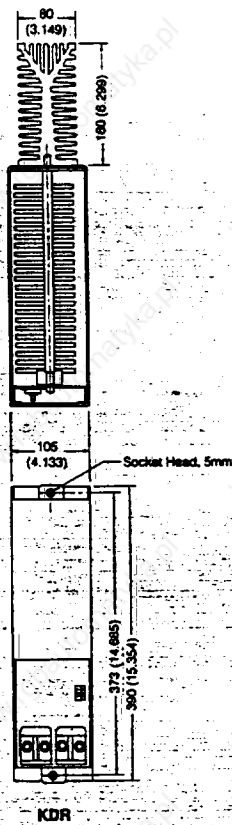
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Dimensions in mm (inches).



KDV Power Supply and KDR Regenerative Power Module Outline Drawings



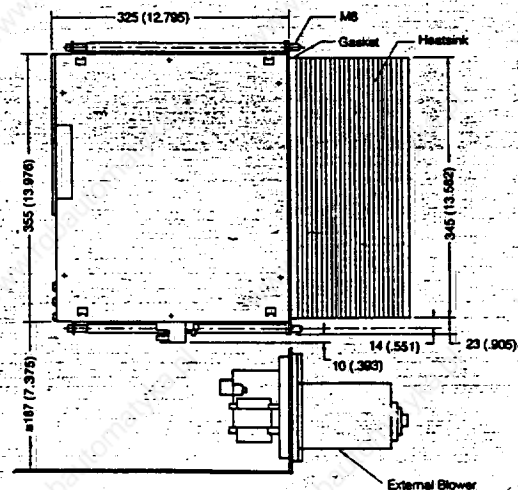
KDV



KDR

Note:

1. Dimensions in mm (inches).
2. M8 is standard metric thread.
3. Outline shown without heat sink cover.
4. Fan is attached to control cabinet.



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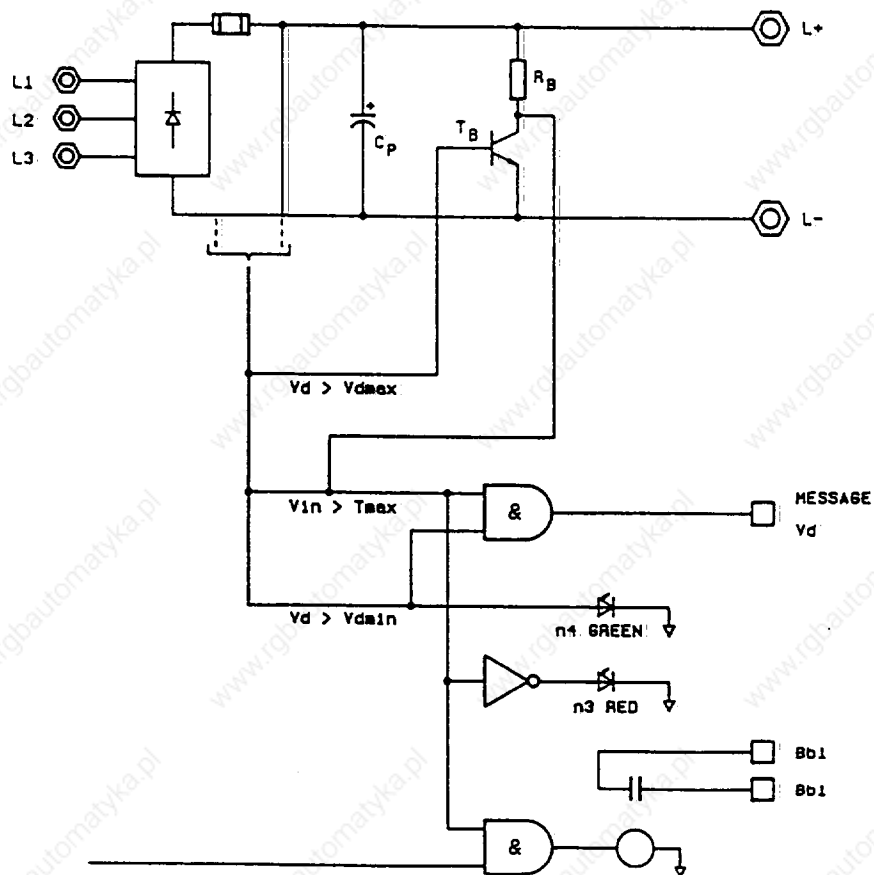
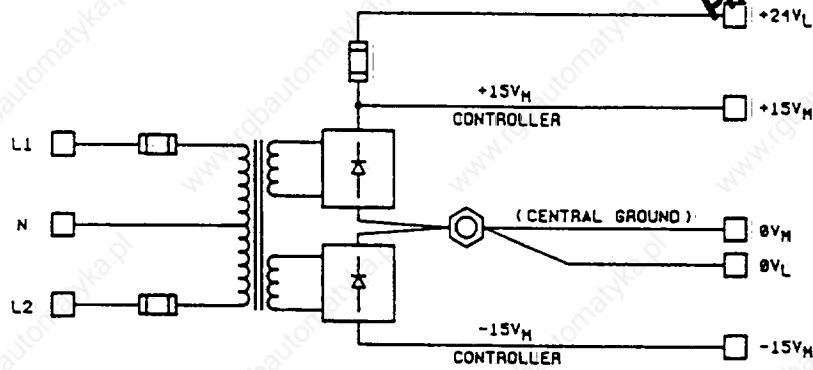


Figure 1-2. TVM Power Supply Schematic

FIG. 6D-8

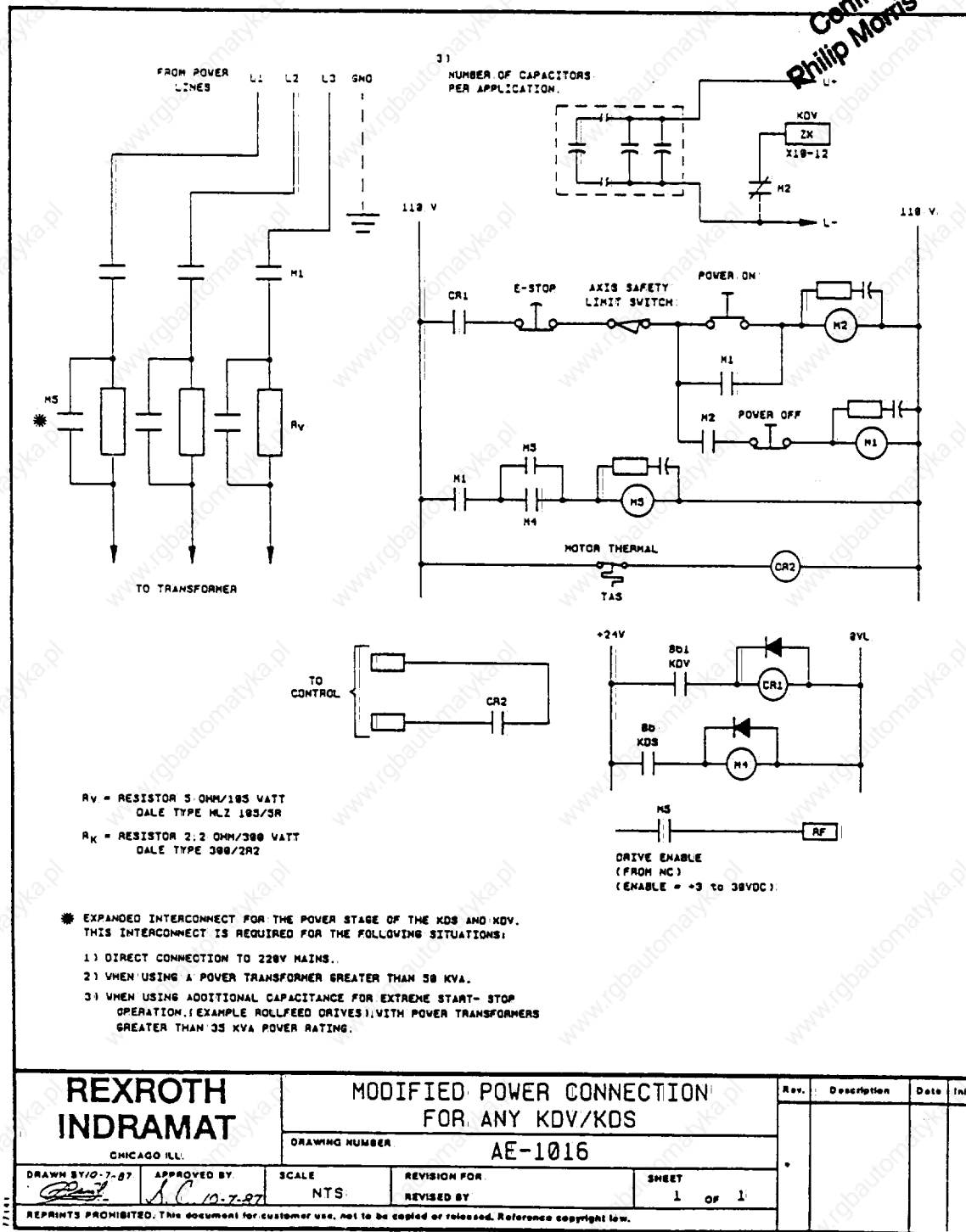


Figure 2-2. KDS/KDV Power Interconnect

Fig. 60-9