Computer Weld Technology, Inc.

DMC-500™

DC Motor Drive Control

Operation / Installation Manual

Manual Part Number: S8M5003

Date: August 11, 1998

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SECTION 1 - OVERVIEW

1.0 Functional Description

The DMC-500™ DC Motor Controller is a SCR motor speed controller using an embedded micro controller to provide motor speed regulation and torque compensation. The controller can be used to control permanent magnet (PM) or shunt wound field motors up to ¼ hp and is designed to be used with the WSC-1000™ Weld Sequence Controller or user supplied controllers.

The DMC-500™ is used to control linear DC drive motors for wire feed and or travel speed functions. The DMC-500™ provides speed and torque regulation using an optical encoder or phase sampled Back EMF. The embedded controller provides precise motor braking and anti-plugging features to extend motor life.

1.1 Remote I/O Control

The DMC-500™ provides remote speed control using a 0-10 VDC input signal. Two 24 VDC inputs provide remote direction control. The control provides an optional isolated encoder output signal. A remote I/O connector located on the rear of the enclosure provides all user control connections.

1.2 Motor Output

The DMC-500™ can be used with 90 VDC permanent magnet or shunt field wound motors up to ¼ H.P. A motor connector located on the rear of the enclosure provides all user motor connections. The control can be used with or without an optical tachometer. The control uses a 60-line optical tach input and can provide a 5 VDC or 15 VDC output for the tachometer. The Tachometer input mode is enabled by an internal jumper connection.

1.3 Operational Status

The operational status of the DMC-500™ is displayed using 4 LED's located on the front panel. The *POWER +24V* LED indicates that power is applied to the controller. The *BRAKE* LED indicates when the motor is at rest or is braking to a stop condition. The *DRIVE ON* led indicates when the drive is active. The *REVERSE* LED indicates when the motor is operating in the reverse direction.

Note: When the motor is active in the forward direction the **DRIVE ON** LED will illuminate. When the motor is active in the reverse direction, the **DRIVE ON** and **REVERSE LED** will illuminate.

1.4 Control Specification

The following are the electrical specifications for the DMC-500™:

- Power Input – 120 vac ± 10% @ 5amps

- Armature Current - 0.5 – 3.0 amps

- Armature Voltage - 0 – 100 vdc

- Field Voltage - 110 vdc nominal

- Field Current - 2.0 amps maximum

- Encoder Input - 5 or 15 vdc 60 lines/rpm max frequency 3.0khz

- Encoder output -   24 vdc pulse

- Forward Input – 24 vdc @ 20ma (Active High)

- Reverse Input – 24 vdc @ 20 ma (Active High)

- Speed Reference Input – 0-10 vdc @ 0.1 ma

The following are the mechanical specifications for the DMC-500™ control:

- Dimensions – 2.0"H x 8.5"W x 11"L (51mm x 165mm x 280mm)

- Mounting Dimensions – 7.5"W x 8.5"L (4 ea 10-32 tapped hole)

- Weight – 5 lbs (2.27 kg)

- Operating Temperature - -10°F to +140°F (-23°C to +60°C)

SECTION 2 - INSTALLATION

2.0 Enclosure Installation

Locate the DMC-500™ enclosure in a convent location. The enclosure can be installed using the four 10-32 mounting holes located on the bottom of the enclosure. Refer to Figure 2-1 for mounting dimensions:
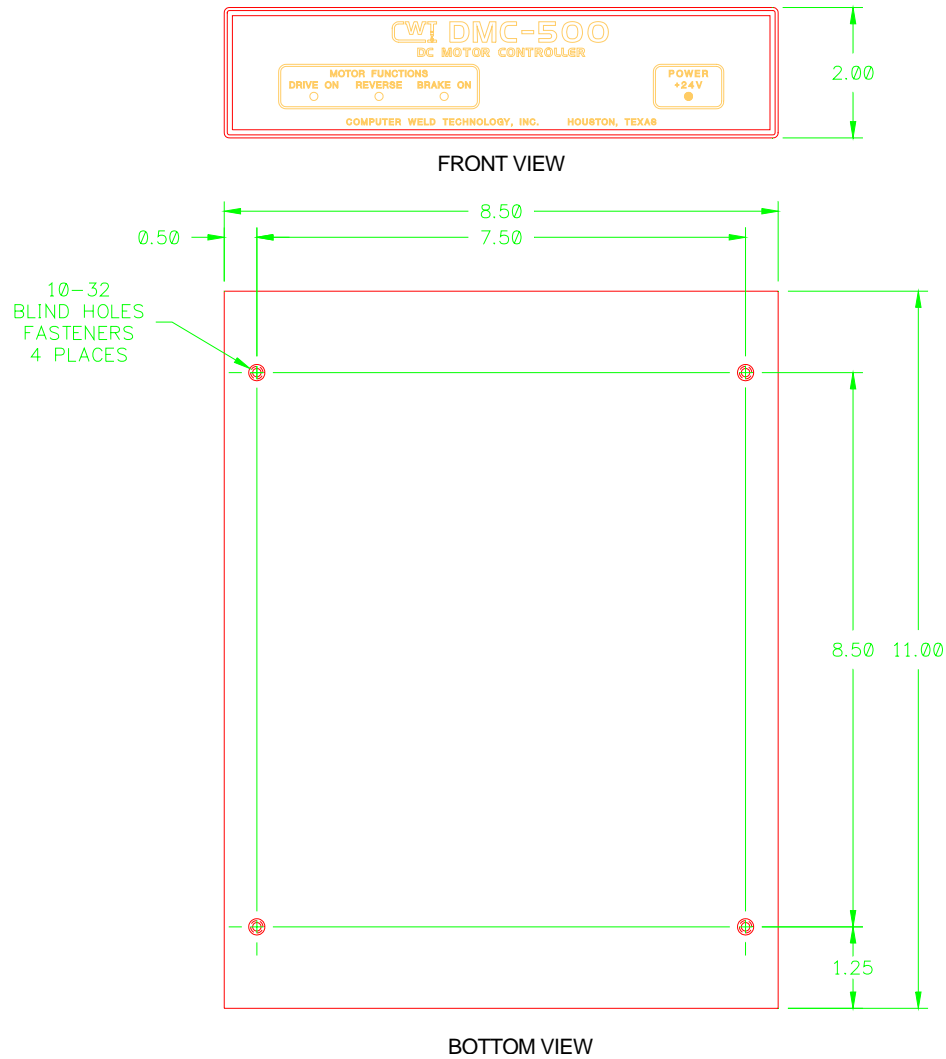

Fig 2-1 DMC-500 Enclosure Mounting dimension

Connect power cable S3W5043 to suitable 115 VAC power outlet. Connect motor control cable to MOTOR connector on rear of enclosure. Connect remote I/O cable (S3W5058) to REMOTE I/O connector on rear of enclosure.

2.1 DC Motor Connector Pin-Out

Several cables are available from the factory, which and can be used for connecting a DC drive motor to the DMC-500™. Consult the factory for available cable assemblies. The following is the pin-out for the DMC-500 motor connector:

PIN	DESCRIPTION
A	+15 VDC for optional encoder
B	+5 VDC for optional encoder
C	Not used
D	Not used
E	Not used
F	Chassis Ground
G	Encoder Pulse input (TTL or 15 Volt Pulse)
H	Encoder Common
J	Motor Field -
K	Motor Armature -
L	Motor Field +
M	Motor Armature +

Figure 2-2   Motor Connector Pin-out

2.2 Optional Encoder Connections

The DMC-500™ can use a 5-volt or 15-volt encoder. Both power outputs are provided on the connector. Connect the optional motor encoder to the correct voltage output. Use Pin A for a 15-volt encoder or Pin B for a 5-volt encoder. The DMC-500™ is designed for a 60-line encoder and can be used for motor speeds up to 3000 rpm. For faster speeds, contact the factory. The following is a typical connection for a 5-volt TTL encoder:
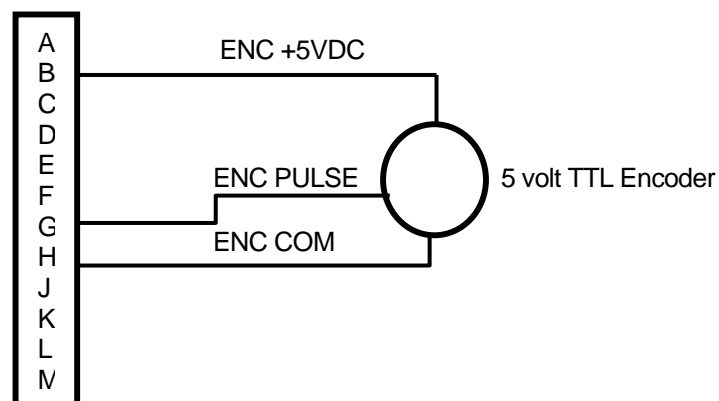

Fig 2-3   5-volt TTL encoder connection

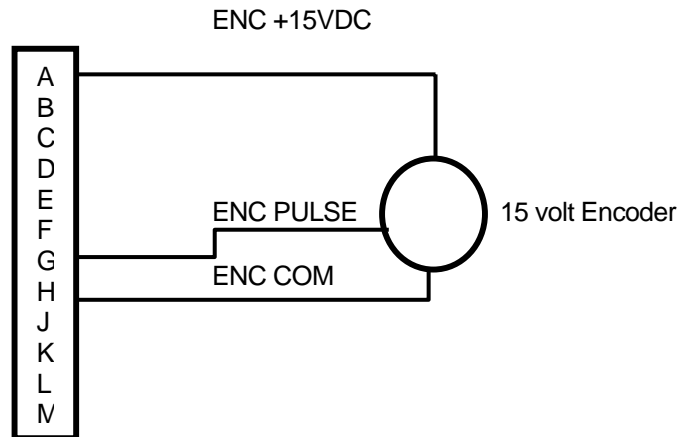The following is the connection diagram for a 15 VDC encoder:

ENC +15VDC

```
A
B
C
D
E        ENC PULSE          15 volt Encoder
F
G        ENC COM
H
J
K
L
M
```

Fig 2-4   15-volt TTL encoder connection

2.3 Enable Optional Encoder

When using an optional encoder the DMC-500™ must be configured for encoder input. To select the Encoder mode remove the cover from the DMC enclosure by removing the six (6) screws on the side of the cover. Locate the jumper labeled *JP-3 TACH* and install a jumper. This enables the Tachometer mode of operation.

Note: *For non-tach applications the jumper on JP-3 TACH must be removed.*

2.4 Motor Connection

The DMC-500 can be used with a permanent magnet, or shunt field motors with an armature rating of 90 – 100 volt dc. The following is the connection diagram for a permanent magnet motor:
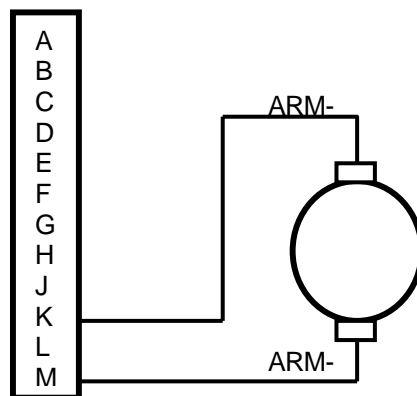
```
A
B
C              ARM-
D
E
F
G
H
J
K
L
M              ARM-
```

Fig 2-4   Permanent magnetic motor wiring

The following is the connection diagram for a shunt field motor:
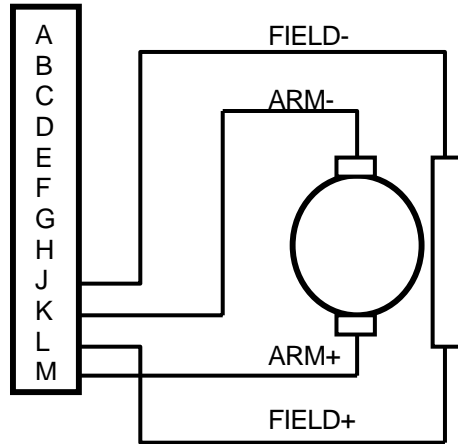
Fig 2-5   Permanent magnetic motor wiring

2.5 Remote I/O Connector Pin-Out

The DMC-500™ is controlled via the REMOTE I/O connector. The control has two (2) 24 VDC inputs for motor direction control, a 0-10 vdc input for speed control and a 24 VDC output. The following is the pin-out for the REMOTE I/O connector:

PIN	FUNCTIONAL DESCRIPTION
A	+24 vdc output @ 100ma
B	24 vdc common
C	Speed Input signal common
D	Speed input signal (0 – 10 vdc)
E	Drive Forward command input (24 vdc @ 10 ma)
F	Drive Reverse command input (24 vdc @ 10 ma)
G	Motor Tachometer output (24 vdc)
H	Frame ground (Cable Shield connection)

Fig 2-6   Remote I/O connector pin-out

A remote I/O cable S3W5058 is available for interfacing the DMC-500™ to the WSC-1000™ controller or for direct interface to user supplied PLC controller. The following is an example of using the DMC-500™ controller with a user supplied PLC controller:
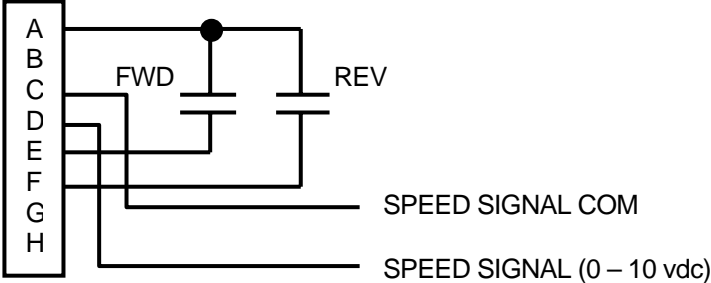

Fig 2-6   PLC interface to DMC-500™

SECTION 3 - OPERATION

3.0 Theory of Operation

The DMC-500 is a direct off-line SCR motor speed controller. The control uses a embedded micro-controller to provide line synchronization, phased back EMF sampling and direction control logic with anti-plug motor reversing. The phased EMF sample provides precise back EMF sample for improve motor speed regulation. The Anti-plug feature prevents reversing the drive before the motor armature has stopped. This prevents excessive motor current and brush arcing in the motor.

The Micro-Controller synchronizes all input commands to the incoming line frequency and assures proper phase angle firing of the power SCR devices. The Analog speed signal is coupled to a Voltage-to-Frequency convert and is electrically isolated from the off-line control. The remote direction control inputs are optically coupled to the controller. An isolated 24-vdc-power supply is provided for all remote input control functions. The user can use this supply to operate remote input relays or switches for direction control. The supply has a solid-state circuit breaker, which protects the 24-volt I/O control from external shorts. The circuit breaker will reset when the 115-vac power is cycled off.

Optional optical tach input is provided which can be used with a 5 or 15 vdc 60-line encoder. The encoder input is also provided as an output on the remote I/O connector. This output is an isolated 24-vdc pulse representing the encoder input. When an encoder is installed on the motor shaft, the DMC-500 can be set for encoder feedback by installing a jumper on JP3. When the jumper is installed, the controller uses the tachometer to regulate motor speed. When the jumper is removed, the controller will use the motor back EMF for speed regulation.

3.1 Control Calibration

The DMC-500™ controller is factory calibrated to produce 2300 rpm with an input of 10 volts. This is performed using a 60 line Tach and a permanent magnet 1/8 motor. No adjustment is required to operate different drive motors. However, there may be a need to check or recalibrate the DMC-500™ for use with a different motor or motor speed range. To calibrate the DMC-500™ perform the following steps:

> Warning - *The DMC-500™ is a direct off-line controller. Due not used grounded instruments during calibration. 115 vac is exposed on the heat sinks used on the PC Board. Only qualified personal should perform test or calibrations on the control.*

1) Remove the cover from the DMC-500™ controller. Connect a calibrated digital voltmeter to the speed reference signal on JP1-3 (-) and JP1-4 (+).

2) If encoder is installed on the drive motor connect a frequency counter to the encoder output JP1-7(+) and JP1-2(-). A 60-line tachometer will produce a direct readout of motor RPM. If a tach is not installed, use a hand tach to measure actual motor RPM.

3) Connect the DMC-500 to a suitable 115vac source. Make sure that the motor is free to rotate then power up the DMC control.

4) Set the speed reference input to zero and activate the drive forward input command. Adjust R4 (MIN) for zero motor RPM.

5) Set the speed reference to 10.0 volts and adjust R3 (MAX) for 2300 (HZ or RPM) or desired motor speed. When using a Tachometer the maximum motor speed is 3000 RPM. If the Tachometer input is disabled (Jumper on JP3) the maximum armature voltage is 105 vdc.

6) Adjusting R3 may change the motor zero input. Repeat Steps 4 and 5 until desire results are obtained.

7) The motor current limit R61 is factory set and should not be changed.

8) Disable the forward direction input. Turn the power off and reinstall the DMC cover.

SECTION 4 – DRAWINGS AND PARTS LISTS

4.1 System Configuration

DMC-500 ENCLOSURE
P/N: S3A5040

POWER CABLE
P/N: S3W5043

REMOTE I/O CABLE
P/N: S3W5058

POWER   MOTOR   REMOTE I/O

MOTOR CABLE
SEE CHARTS BELOW

TO WRC-1000 ENCLOSURE
OR USERS PLC
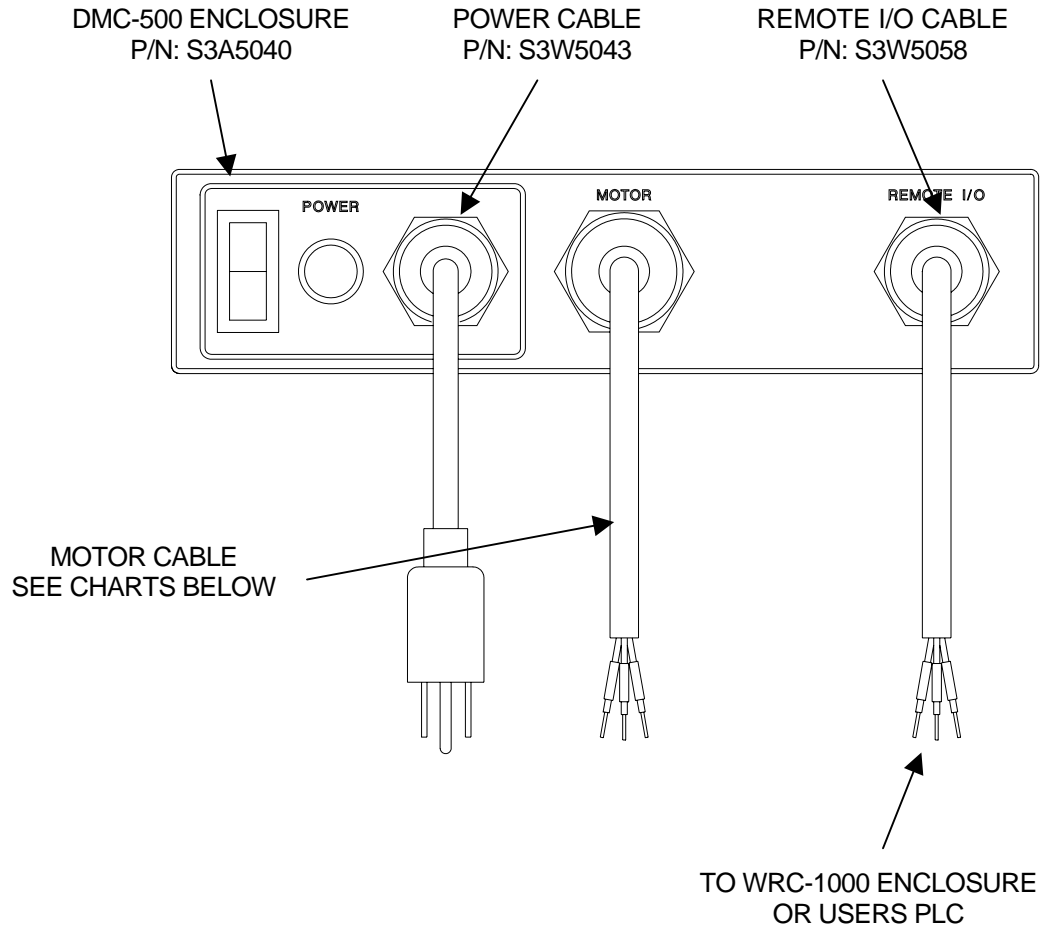
MOTOR CABLE CHART	
PART NUMBER	**DESCRIPTION**
S3W5059	MILLER A1D4 MOTOR CABLE
S3W5060	STANDARD MOTOR WITHOUT TACH CABLE
S3W5072	LINCOLN NA5 MOTOR CABLE
S3W5073	STANDARD MOTOR WITH TACH CABLE

4.2 System Schematic Diagram

P1
HOT
NEUTRAL
GROUND

A — BLACK 18 AWG — JP9 1 — JP9 1
B — WHITE 18 AWG — 2 — 2
C — GREEN 18 AWG — 3 — 3

PT07A-12-3P
POWER

POWER IN

F1
5 AMP 3AG

BLACK 18 AWG — JP8 1 — JP8 1
BROWN 18 AWG — 2 — 2
3 — 3
WHITE 18 AWG — 4 — 4
GRAY 18 AWG — 5 — 5
YELLOW 18 AWG — 6 — 6

ARROWHART 1600R11E

S1
2
3
1

POWER OUT

DMC-500 SCR P.C.B. ASSEMBLY
P/N: S5A5028

P2
+15V
+5V

A — YELLOW 22 AWG — JP2 1 — JP2 1
B — RED 22 AWG — 2 — 2
C — 3 — 3
D — 4 — 4
E

GROUND
ENC
COM
FIELD-
ARM-
FIELD+
ARM+

F — GREEN 22 AWG
G — WHITE 22 AWG
H — BLACK 22 AWG
J — BLACK 16 AWG — JP7 1 — JP7 1
K — BROWN 16 AWG — 2 — 2
L — YELLOW 16 AWG — 3 — 3
M — RED 16 AWG — 4 — 4

ENCODER

PT07A-14-12S
MOTOR

MOTOR

P3
+24V
COM
SPEED-
SPEED+
FWD+
FWD-
ENC
GROUND

A — BROWN 22 AWG — JP1 1 — JP1 1
B — BLACK 22 AWG — 2 — 2
C — BLUE 22 AWG — 3 — 3
D — ORANGE 22 AWG — 4 — 4
E — VIOLET 22 AWG — 5 — 5
F — GRAY 22 AWG — 6 — 6
G — GREEN/WHITE 22 AWG — 7 — 7
H — RED/WHITE 22 AWG — 8 — 8

PT07A-12-8S
I/O

I/O

4.3 DMC-500 Enclosure Details
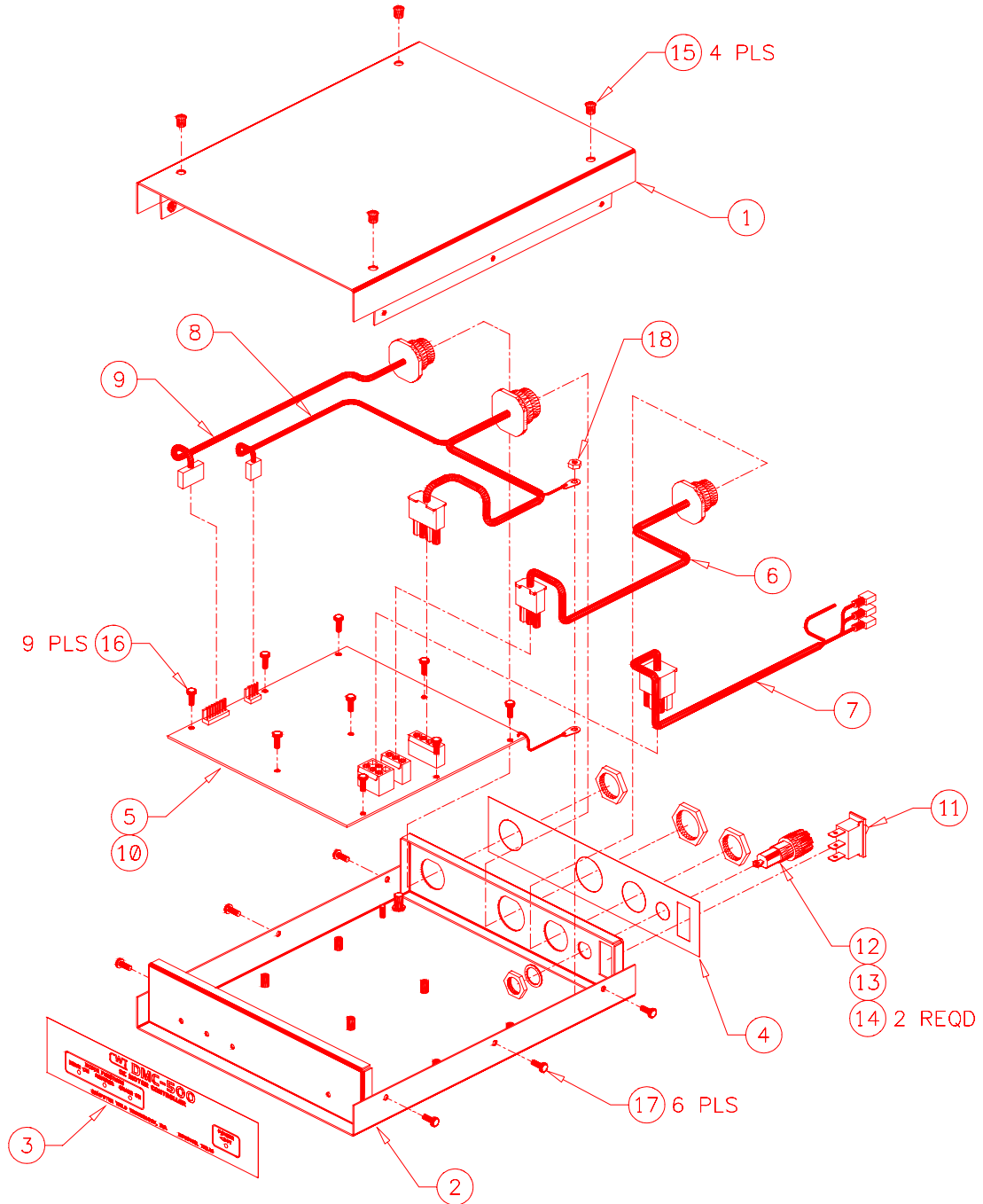
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	S3E5044	COVER
2	1	S3E5052	ENCLOSURE
3	1	S3E5054	FRONT OVERLAY
4	1	S3E5055	REAR OVERLAY
5	1	S5A5028	DMC-500 SCR PCB ASSEMBLY
6	1	S3W5054	POWER IN CABLE
7	1	S3W5055	POWER OUT CABLE
8	1	S3W5056	SCR MOTOR CABLE
9	1	S3W5057	INTERNAL I/O CABLE
10	1	S5I5013	DMC-500 SCR PROCESSOR
11	1	X3S5078	ROCKER SWITCH
12	1	X3C0003	FUSE HOLDER
13	1	X3C5021	5 AMP 3AG FUSE
14	2		¼" DIAMETER X ½" LONG HEAT SHRINK TUBING
15	4	X6Z5071	¼" HOLE DOME PLUG
16	9		#6-32 X 3/8" LONG PAN HEAD SCREW W/ INT LOCK WASHER
17	6		#6-32 X ¼" LONG SOCKET BUTTON HEAD SCREW
18	1		#6-32 HEX NUT