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# M60 Troubleshooting Guide

A brief troubleshooting guide for Siemens M60 controllers

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Rev 1.3
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## I. Introduction

The first purpose of this guide is to help field technicians perform a quick analysis of possible M60 controller hardware issues. In some cases it also provides information for repair at the signal shop level. The idea is to maximize the effectiveness of the technicians and reduce the need for an RMA.

The second purpose of this guide is to improve the amount and quality of information that accompanies a controller when it must be returned for repair. This information will help the factory more quickly reproduce the issue and discover the root cause. Having better root cause information, in turn, helps us discover and address areas that may have quality issues.

This guide helps even non-technical users make important observations before requesting an RMA. For the more experienced technical user it provides additional instructions for detailed observations and for basic repairs.

### A. Safety Notice

M60 controllers contain hazardous voltages. Death, serious personal injury, or property damage can result if safety instructions are not followed. Only qualified personnel should work on or around this equipment after becoming thoroughly familiar with all warnings, safety notices, and maintenance procedures contained herein. The successful and safe operation of this equipment is dependent upon proper handling, installation, operation and maintenance.

#### *Qualified Person*

For the purposes of this guide, a qualified person is one who is familiar with the installation, construction and operation of the equipment, and the hazards involved. In addition, he or she has the following qualifications:

- Is trained and authorized to energize, de-energize, clear, ground and tag circuits and equipment in accordance with established safety practices.
- Is trained in the proper care and use of protective equipment such as rubber gloves, hard hat, safety glasses and face shields, flash clothing, etc., in accordance with established safety practices.
- Is trained in rendering first aid.

#### *Warning*

For the purposes of this guide, Warning indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

#### *Caution*

For the purposes of this guide, Caution indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

 

# II. Symptoms, Causes and Solutions

The following table can be used to help make local diagnoses and in some cases repairs. If an RMA is required, information from this table and the actions taken for diagnosis should be included in the RMA request to help the factory reproduce and repair the problem.

| State | Symptoms | Likely Causes | Solutions |
|---|---|---|---|
| No power | no lights in the IRED window,<br>no beep from display, and<br>no cursor on display | a) no AC power to controller<br>b) blown fuse<br>c) dead power supply | a) check AC power input<br>b) check/replace 3A slow blow fuse<br>c) check/replace power supply (see IV.B) |
| Not booting | lights in the IRED window,<br>cursor present on blank display, and<br>engine board shows RGS [1] | a) low 5VDC or bad TTL signals<br>b) high impedance at DC connector<br>c) RTC kernel hangs | a) check/replace power supply (see IV.B)<br>b) check voltage drop (NEMA only), then RMA* (I.B.3)<br>c) RMA |
| Rebooting constantly | lights in the IRED window, and<br>display flashes or beeps every few seconds | a) high impedance at DC connector<br>b) low 5VDC or bad TTL signals | a) check voltage drop (NEMA only), then RMA* (I.B.3)<br>b) check/replace power supply (see IV.B) |
| No application running | lights in the IRED window,<br>cursor present on blank display,<br>FIO Timeout LED is lit (see I.B), and<br>engine board shows RDB [2] | a) SEPAC not installed<br>b) SEPAC not configured to start | a) reboot; check license and startup config in SafeSuite Web<br>b) check SEPAC startup (see IV.A) / contact ISC[†] |
| Preempt at startup | cabinet in flash,<br>SEPAC F-1-1-1 screen shows<br>`STRT FLSH - W/PREEMPT` | a) stuck preempt input<br>b) bad opto isolator in cabinet<br>c) bad 24VDC | a) check preempt inputs<br>b) check BIU optos or opto cards<br>c) check/replace power supply (see IV.B) |
| Persistent MMU/CMU CVM | cabinet in flash,<br>MMU/CMU shows CVM fault, and<br>SEPAC Local Alarms log shows or<br>`DIAG: FIELDIO FAIL` or<br>`DIAG: FIO RESET` | a) bad FIO<br>b) bad 24VDC<br>c) ribbon cable partial disconnect | a) check FIO operation via diagnostic LEDs (see I.B)<br>b) check/replace power supply (see IV.B)<br>c) RMA |
| MMU/CMU SDLC Fail | cabinet in flash,<br>MMU shows `PORT 1 FAIL`<br>no SDLC lights on BIU or MMU, and<br>SEPAC is running | a) SEPAC misconfigured<br>b) SDLC cable issue<br>c) bad SDLC transceiver | a) confirm TS2 mode & BIUs enabled on F-4-7 screen<br>b) check SDLC cabling in cabinet<br>c) RMA |

Notes:

[1] RGS – Red & Green Steady: Armadillo engine board's red and green LEDs are both on if Linux has not booted (see I.A).

[2] RDB – Red Double Blink: Armadillo engine board's red LED double blinks when Linux is booted and running (see I.A).

*RMA if voltage drop across 5VDC is greater than 0.05 volts (see I.B.3). Package to minimize shock and vibration during shipping.

[†]ISC – ITS Support center, +1 877-420-2070, stssupportmobility.industry@siemens.com.

Table 1: Symptoms and Solutions

 

# III. Basic Observations

These are observations which can be made using only a screwdriver, and a Mark-1 eyeball.

## A. Engine Board Operation

This checks whether the Armadillo engine board has booted Linux by observing the red and green diagnostic LEDs (D2 & D1, respectively) near the top right corner of the engine board (Figure 1). A Red Double Blink indication (RDB) means that the Linux operating system is up and running. A Red & Green Steady indication (RGS) means that Linux is not fully booted. This could be for several reasons.

*Note:* this observation applies to Armadillo ATC8309 (ACP17079) engine boards only. For older engine boards, consult the ITS Help Desk.

M60-NEMA controllers:

1. Remove back plate or peek through slots. Warning: high voltage is exposed in the power supply bay when the back plate is removed

M60-ATC controllers:

1. Remove display (#2 Phillips) and blanking panel behind it (#1 Phillips)
2. LEDs cannot be observed directly, but the RDB can be clearly noted by reflected light

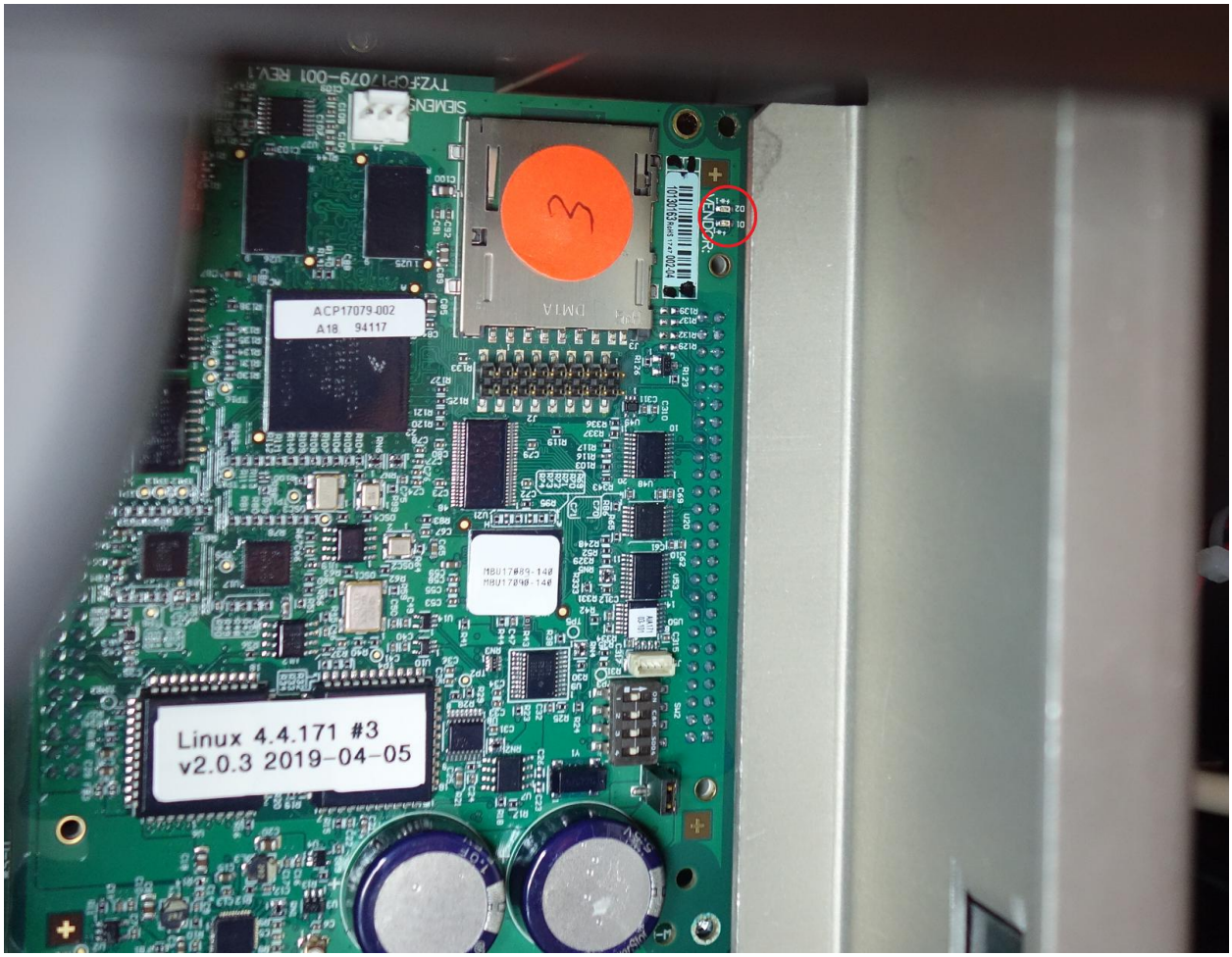


Figure 1: Armadillo Diagnostic LEDs

 

## B. FIO Operation

This checks that the M60 Field I/O is operational by observing the 4 diagnostic LEDs as shown in Figure 2 and interpreted by Table 2.

M60-NEMA controllers:

1. Remove back plate to see LEDs or peek through slots. Warning: high voltage is exposed in the power supply bay when the back plate is removed

M60-ATC controllers with backplanes labeled FCP17047-001 Rev 1, 2 or 3 (not applicable to Rev 4):

1. Remove back plate
2. Peek through right-hand mounting hole for C60P

M60-ATC controllers (all):

1. Remove display and blanking panel behind it
2. Use a piece of paper or small mirror to see reflections from the LEDs

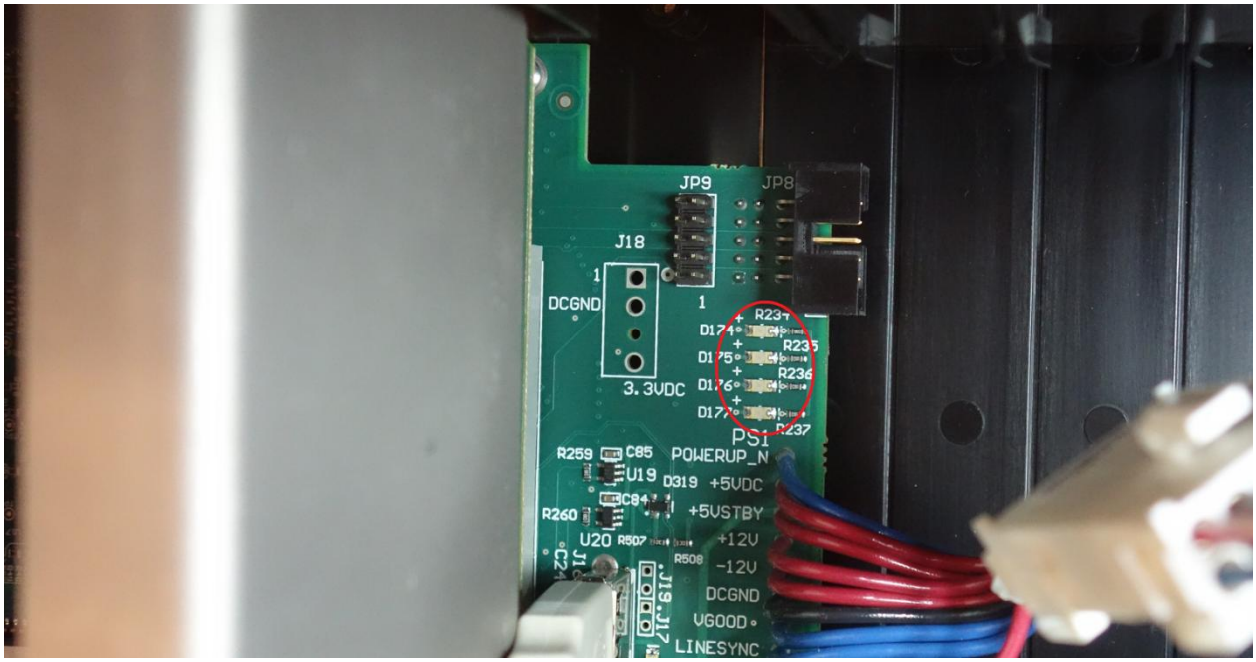


Figure 2: Field I/O Diagnostic LEDs

| LED | Function | Activity |
|---|---|---|
| D174 (Top) | Timeout | Normally dark; illuminated when no FIO traffic for 2 seconds |
| D175 | Transmit | Normally flickers dimly with FIO traffic |
| D176 | Receive | Normally flickers dimly with FIO traffic |
| D177 (Bot) | Watchdog | Normally flashes at 5 Hz when FIO CPU is running |

Table 2: FIO Diagnostic LEDs

 

# IV. Advanced Observations and Tests

These are additional observations and tests which require a voltmeter, a terminal emulator with appropriate cable, and some Linux knowledge.

## A. SEPAC Startup

This determines if the controller has started or is attempting to start SEPAC. Requires an M50/M60 console serial port cable and terminal emulator set for 115200 baud, 8 bits, no parity, and one stop bit.

1. Log in as root user from console port
2. Run **`pgrep -a sepac`**; if SEPAC process not listed (i.e., not running), do step 3 to check startup
3. Run **`ls /etc/rc.d/rc.siemens/*`** and look for `S51sepac` in the startup list; note the capital 'S'. Absence or a lower case 's' indicates that SEPAC is not attempting to start

## B. Power Supply Tests

These tests check the DC power rails and the power supply logic signals as shown in Table 3. Power supplies outside this range should be considered suspect.

### 1. Power Supply Voltages (NEMA only)

This test requires needle probes reach the pins on the *power supply side* of the 12-pin DC connector.

a. Remove back plate. Warning: high voltage is exposed in the power supply bay
b. Test the voltages on the power supply side of 12-pin DC power connector (Figure 3)

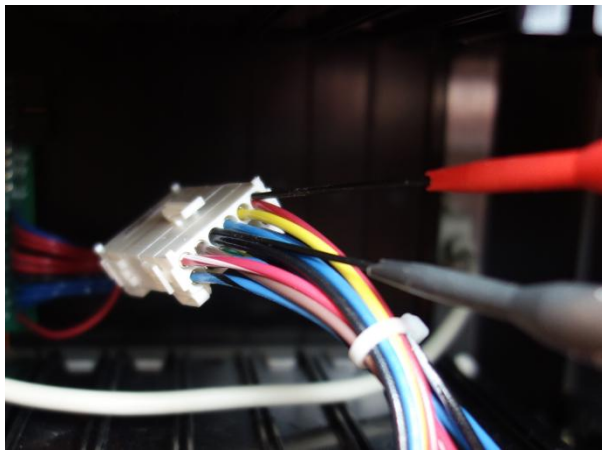

Figure 3: DC Connector with Leads

### 2. Circuit Board Voltages (ATC only)

This test measures the voltages at the ATC backplane test points.

a. Remove back plate
b. Test the voltages at the backplane test points (Figure 4)

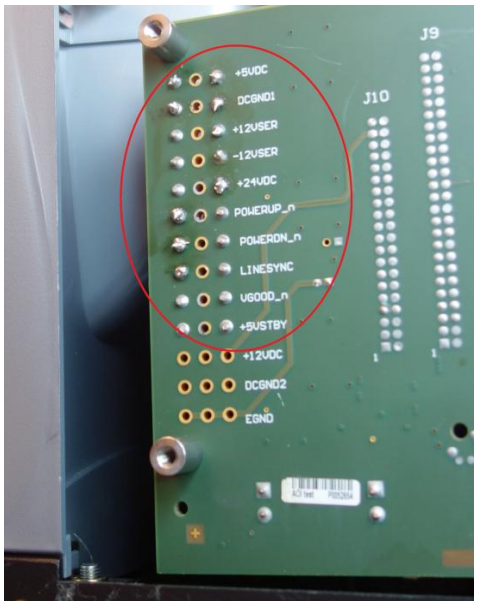


Figure 4: ATC Backplane Test Points

 

### 3. Connector Voltage Drop (NEMA only)

This test requires needle probes to reach the pins on the *Field I/O side* of the 12-pin connector. Use in conjunction with Test 1 to check for poor connections. Minimize connector motion as much as possible.

a. Switch off controller
b. Remove display and blanking panel behind it
c. Apply power
d. Test the voltages on the FIO side of the 12-pin DC connector
e. Run Test 1 and compare, particularly the 5VDC

| Output | Voltage Range | Wire Color |
|---|---|---|
| +5VDC | 4.875 to 5.175 VDC | red |
| +12VSER | 11.4 to 12.6 VDC | yellow |
| –12VSER | –11.4 to –12.6 VDC | blue |
| +24V | 22 to 26 VDC | red w/ white |
| +5VSTBY | less than 4.9 VDC and rising | brown |
| LineSync | approx 2-3 VDC RMS (i.e., 0-5 V 60 Hz square wave) | blue w/ black opposite brown |
| PowerUp | greater than 4 VDC | blue w/ black opposite blue |
| PowerDown | greater than 4 VDC | blue w/ black opposite yellow |
| VGood | less than 0.8 VDC | blue w/ black opposite red w/ white |

Table 3: Test Voltages to DC Ground 1

# V. Power Supply Removal and Installation

## A. Remove Power Supply

To remove power supply:

1. *Turn off and unplug controller.* Caution: capacitors may retain high voltages for a minute
2. NEMA only – remove back plate
3. ATC only – remove display (#2 Phillips) and blanking panel behind it (#1 Phillips)
4. Unplug 12-pin DC power connector
5. Remove 4 power supply screws (#2 Phillips) and partially drop supply
6. Unplug 3-pin AC power connector
7. If blue earth ground wire is attached, remove from under PCB screw (#2 Phillips)
8. Remove supply including two-hole rubber safety block

## B. Install Power Supply

To install power supply:

1. Install safety block over fuse holder and switch
2. Partially insert supply
3. Plug in 3-pin AC power connector to FIO board
4. If blue earth ground wire is present, install spade lug under PCB screw. *Important:* be certain that the lock washer or the insulating washer (if present) is *under* the spade lug
5. Fully insert supply making sure switch and fuse holder are protected with rubber block
6. Install 4 power supply screws
7. Plug in 12-pin DC power connector
8. Test voltages as detailed on page 6
9. Button up controller

 

# VI. Worksheet and Notes

| | | |
|---|---|---|
| +5VDC | _____ | +4.875 to +5.175 |
| +12SER | _____ | +11.4 to +12.6 |
| –12SER | _____ | –11.4 to –12.6 |
| +24VDC | _____ | +22 to +26 |
| +5VSTBY | _____ | rising to ~4.9 |
| Linesync | _____ | +2 to +3 (+5 sq wave) |
| PowerUp | _____ | High (> +4) |
| PowerDn | _____ | High (> +4) |
| V-Good | _____ | Low (< +0.8) |

| | | | | |
|---|---|---|---|---|
| D174 | T-out | ☐ On | ☐ Off | ☐ Other |
| D175 | Trans | ☐ On | ☐ Off | ☐ Flicker |
| D176 | Recv | ☐ On | ☐ Off | ☐ Flicker |
| D177 | W-dog | ☐ On | ☐ Off | ☐ Flash |
| D1 | Green | ☐ On | ☐ Off | ☐ Flash |
| D2 | Red | ☐ On | ☐ Off | ☐ Flash |
| `pgrep` | | ☐ Listed | | ☐ Not listed |
| `S51sepac` | | ☐ Present | | ☐ Absent |

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