Microprocessor Controls
MP7650 Modbus Communications

Introduction
Modbus RS-485 communication may be added to the MP7650 controller on request. This communication will allow the user to poll information from the Transfer Switch on the current status, but READ only access is provided.

<table>
<thead>
<tr>
<th>MP7650 Pin Out</th>
<th>RS-485 Connections</th>
</tr>
</thead>
<tbody>
<tr>
<td>D0</td>
<td>T/R - (B)+</td>
</tr>
<tr>
<td>D1</td>
<td>T/R - (A)-</td>
</tr>
<tr>
<td>C</td>
<td>Ground</td>
</tr>
</tbody>
</table>

Modbus Specification - 09/11/2018
1. The implementation is Modbus RTU.
2. The electrical implementation is RS-485 "Two-Wire."
   a. The connector is a 3-position "European style" unpluggable screw terminal.
   b. The terminals are labeled D0, D1, and C.
   c. The RS-485 is electrically isolated from the ATS Control circuitry, to 2500Vrms galvanic:
   d. The RS-485 interface includes +/-15kV ESD protection.
3. The following parameters are selectable as shown through the ATS Control's Menu System.
   a. Address is selectable from 1 through 247; initial default is 205.
   b. Baud rate is selectable as 9600, 19200, 38400, 57600, or 115200; initial default is 19200.
   c. Parity is selectable as even, odd, or none; initial default is even.
4. The Modbus mapping follows:
   Notes: 1. Unused items (bits/bytes/words) return 0.
         2. Time-of-day and Exerciser clock times are in 24-hour format.

Function 01 Read Coils (Discrete Outputs) Currently #1 through #38 readable.
1. NPA - Normal Power Available
2. EPA - Emergency Power Available
3. SIN - System In Normal
4. SIE - System In Emergency
5. TE - Trip Emergency
6. /TRBL - Not Trouble
7. OE - Open Emergency
8. TN - Trip Normal
9. GF - Ground Fault
10. NIA - Not in Automatic
11. NBT - Normal Breaker Tripped
12. EBT - Emergency Breaker Tripped
13. ON - Open Normal
14. AS - Auto Sync Enable
15. ASIN - Auxiliary System In Normal
16. ASIE - Auxiliary System In Emergency
17. NRP - Normal Reverse Power
18. ERP - Emergency Reverse Power
19. EW - Emergency Withdrawn
20. unused
21. CE - Close Emergency
22. AEB - Emergency Bypassed
23. AEMR - Auxiliary Emergency Available
24. ACBT - Auxiliary Contacts Before Transfer
25. NT - Normal Tripped
26. ET - Emergency Tripped
27. NW - Normal Withdrawn
28. unused
29. ES - Engine Start
30. CN - Close Normal
31. ANB - Auxiliary Normal Bypassed
32. ANOR - Auxiliary Normal Power Available
33. NBBT - Normal Bypass Breaker Tripped
34. EBBT - Emergency Bypass Breaker Tripped
35. NBW - Normal Bypass Withdrawn
36. EBW - Emergency Bypass Withdrawn
37. NB - Normal Bypassed
38. EB - Emergency Bypassed

Function 02 Read Discrete Inputs – Currently #1 Through #32 readable.
1. NOR - Normal Power Available
2. EMR - Emergency Power Available
3. NAX - Normal Switch Closed
4. EAS - Normal Switch Closed
5. EAX - Emergency Switch Closed
6. LTS - Load Test Switch Closed
7. ALTS - Auxiliary Load Test Switch Closed
8. MSE - Keypad Enabled
9. BAN - Bypass Normal Switch Closed
10. RN - Return to Normal
11. RD - Remote Disconnect
12. NBA - Normal Bell Alarm
13. EBA - Emergency Bell Alarm
14. GFR - Ground Fault Relay
15. NAW - Normal Switch Withdrawn
16. BEA - Bypass Emergency Switch Closed
17. PS - Peak Shave
18. RPN - Reverse Power Normal
19. RPE - Reverse Power Emergency
20. SYNC - Source in Sync
21. LOI - Load Demand Inhibit
22. XIN - Spare Input
23. NAT - Normal Switch In Test
24. EAT - Emergency Switch In Test
25. unused
26. unused
27. unused
28. unused
29. BNBA - Bypass Normal Bell Alarm
30. SEBA - Bypass Emergency Bell Alarm
31. BNW - Bypass Normal Withdrawn
32. BEW - Bypass Emergency Withdrawn

Function 03 Reading Holding Registers – Currently #1 through #62 readable.
1. Discrete Outputs #49-#64 (all currently unused).
   Bit 0. Output #49.
   Bit 1. Output #50.
   Bit 2. Output #51.
   Bit 3. Output #52.
   Bit 4. Output #53.
   Bit 5. Output #54.
   Bit 6. Output #55.
   Bit 7. Output #56.
   Bit 8. Output #57.
   Bit 9. Output #58.
   Bit 10. Output #59.
   Bit 11. Output #60.
   Bit 12. Output #61.
   Bit 13. Output #62.
   Bit 14. Output #63.
   Bit 15. Output #64.
2. Discrete Outputs #33-#48 (#39-#48 currently unused).
   Bit 0. Output #33.
   Bit 1. Output #34.
   Bit 2. Output #35.
   Bit 3. Output #36.
   Bit 4. Output #37.
   Bit 5. Output #38.
   Bit 6. Output #39.
   Bit 7. Output #40.
   Bit 8. Output #41.
   Bit 9. Output #42.
3. Discrete Outputs #17-#32
   Bit 0. Output #17.
   Bit 1. Output #18.
   Bit 2. Output #19.
   Bit 3. Output #20.
   Bit 4. Output #21.
   Bit 5. Output #22.
   Bit 6. Output #23.
   Bit 7. Output #24.
   Bit 8. Output #25.
   Bit 10. Output #27.
   Bit 11. Output #28.
   Bit 12. Output #29.
   Bit 15. Output #32.

4. Discrete Outputs #1-#16
   Bit 0. Output #1.
   Bit 1. Output #2.
   Bit 2. Output #3.
   Bit 3. Output #4.
   Bit 4. Output #5.
   Bit 5. Output #6.
   Bit 6. Output #7.
   Bit 7. Output #8.
   Bit 8. Output #9.
   Bit 10. Output #11.
   Bit 11. Output #12.
   Bit 14. Output #15.
   Bit 15. Output #16.

5. Discrete Inputs #33-#48 (all currently unused).
   Bit 0. Input #33.
   Bit 1. Input #34.
   Bit 2. Input #35.
   Bit 3. Input #36.

6. Discrete Inputs #17-#32
   Bit 0. Input #17.
   Bit 1. Input #18.
   Bit 2. Input #19.
   Bit 3. Input #20.
   Bit 4. Input #21.
   Bit 5. Input #22.
   Bit 6. Input #23.
   Bit 7. Input #24.
   Bit 8. Input #25.
   Bit 10. Input #27.
   Bit 11. Input #28.
   Bit 12. Input #29.
   Bit 13. Input #30.
   Bit 15. Input #32.

7. Discrete Inputs #1-#16
   Bit 0. Input #1.
   Bit 1. Input #2.
   Bit 2. Input #3.
   Bit 3. Input #4.
   Bit 4. Input #5.
   Bit 5. Input #6.
   Bit 6. Input #7.
   Bit 7. Input #8.
   Bit 8. Input #9.
   Bit 10. Input #11.
   Bit 11. Input #12.
   Bit 12. Input #13.
   Bit 13. Input #14.
   Bit 15. Input #16.
Bit 15. Input #16.
8. TSP Firmware Major Version.
9. TSP Firmware Sub-Version.
10. TSP Firmware date: Msb = year – 2000; lsb month (January 1).
11. MBP Firmware Major Version.
12. MBP Firmware Sub-version.
13. MBP Firmware date: Msb = year – 2000; lsb month (January 1).
14. unused
15. ATS Configuration.
   Lsb = Mode (Off = 0, Automatic 1, Hand Crank 2, Load Test 3).
17. unused
18. Nonvolatile Background Fault Flags:
   Bit 0. Close Emergency fault.
   Bit 1. Close Normal fault.
   Bit 2. Open Emergency fault.
   Bit 3. Both Closed fault.
   Bit 4. Both Closed fault.
   Bit 5. Bypass fault.
   Bit 6. Ground fault.
   Bit 12. Trip Emergency.
   Bit 13. Trip Normal.
   Bit 14. unused
   Bit 15. unused
19. Nonvolatile Background Trouble Flags:
   Bit 0. Synchronization Failure trouble.
   Bit 1. Ground trouble.
   Bit 3. Emergency Reverse Power trouble.
   Bit 4. unused.
   Bit 5. unused.
   Bit 6. unused.
   Bit 7. unused.
   Bit 8. unused.
   Bit 9. unused.
   Bit 10. unused.
   Bit 11. unused.
   Bit 12. unused.
   Bit 13. unused.
   Bit 14. unused.
   Bit 15. unused.
20. Nonvolatile Foreground Flags:
   Bit 0. Clear indicates memory corruption not yet acknowledged by the operator.
   Bit 1. Indicates that the ATS automatically adjusts for Daylight Savings Time.
   Bit 2. Indicates U2 preference for a Utility-to-Utility ATS.
   Bit 3. Indicates transfer desired upon synchronization failure timeout.
   Bit 4. unused.
   Bit 5. unused.
   Bit 6. unused.
   Bit 7. unused.
   Bit 8. unused.
   Bit 9. unused.
   Bit 10. unused.
   Bit 11. unused.
   Bit 12. unused.
   Bit 13. unused.
   Bit 14. unused.
   Bit 15. unused.
21. unused.
22. unused.
23. TOES timer setting, in centi-seconds (0 if timer unused).
24. TOES timer time remaining, in centi-seconds (0 if timer unused or inactive).
25. TDE timer setting, in centi-seconds (0 if timer unused).
26. TDE timer time remaining, in centi-seconds (0 if timer unused or inactive).
27. TDBT timer setting, in centi-seconds (0 if timer unused).
28. TDBT timer time remaining, in centi-seconds (0 if timer unused or inactive).
29. SPPT timer setting, in centi-seconds (0 if timer unused).
30. SPPT timer time remaining, in centi-seconds (0 if timer unused or inactive).
31. TDN timer setting, in centi-seconds (0 if timer unused).
32. TDN timer time remaining, in centi-seconds (0 if timer unused).
33. TDR timer setting, in milli-minutes (0 if timer unused).
34. TDR timer time remaining, in milli-minutes (0 if timer unused or inactive).
35. TDEC timer setting, in milli-minutes (0 if timer unused).
36. TDEC timer time remaining, in milli-minutes (0 if timer unused or inactive).
37. MRT timer setting, in milli-minutes (0 if timer unused).
38. MRT timer time remaining, in milli-minutes (0 if timer unused or inactive).
39. SFT timer setting, in milli-minutes (0 if timer unused).
40. SFT timer time remaining, in milli-minutes (0 if timer unused or inactive).
41. unused.
42. unused.
43. unused.
44. unused.
45. unused.
46. unused.
47. unused.
48. unused.
49. unused.
50. unused.
51. unused.
52. unused.
53. unused.
54. unused.
55. Msb Current Year – 2000 (0 if the clock is not set).
   Lsb Current Month, starting with January = 1 (0 if the clock is not set).
56. Msb Current Date (0 if the clock is not set).
   Lsb Current Day, starting with Sunday = 1 (0 if the clock is not set).
57. Msb Current Hour (0 if the clock is not set).
   Lsb Current Minute (0 if the clock is not set).
58. Msb Current Second (0 if the clock is not set).
   Lsb Interrupt Number within the current second, 0 through 199 (200 is possible rarely).
59. unused.
60. Exerciser Flags:
   Bit 0. Indicates exercising is without load.
   Bit 1. Indicates Sunday is an exercise day.
   Bit 2. Indicates Monday is an exercise day.
   Bit 3. Indicates Tuesday is an exercise day.
   Bit 4. Indicates Wednesday is an exercise day.
   Bit 5. Indicates Thursday is an exercise day.
   Bit 6. Indicates Friday is an exercise day.
   Bit 7. Indicates Saturday is an exercise day.
   Bit 8. Indicates exercising occurs during the 1st seven days of each month (dates 1-7).
   Bit 9. Indicates exercising occurs during the 2nd seven days of each month (dates 8-14).
   Bit 10. Indicates exercising occurs during the 3rd seven days of each month (dates 15-21).
   Bit 11. Indicates exercising occurs during the 4th seven days of each month (dates 22-28).
   Bit 12. Indicates exercising occurs during any remaining days each month (dates 29-31).
   Bit 13. unused.
   Bit 14. unused.
   Bit 15. unused.
61. Exercise beginning time of day: Msb = hour; lsb minute.
62. Exercise duration in minutes (0 through 1440).
MP7650 - Field Replaceable Unit (F.R.U.)

Microprocessor System Specifications

<table>
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<tr>
<th>Specification</th>
<th>Details</th>
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<tr>
<td>Operating Voltage</td>
<td>12Vdc or 24Vdc</td>
</tr>
<tr>
<td>Power Consumption: Passive Monitoring</td>
<td>24 ~ 48 VA</td>
</tr>
<tr>
<td>Power Consumption: Operating MC Units</td>
<td>Max Inrush: 260 VA</td>
</tr>
<tr>
<td>Power Consumption: Operating IC Units</td>
<td>Max Inrush: 500 VA</td>
</tr>
<tr>
<td>Customer Connection Contact Type</td>
<td>Form “C” Dry Contacts</td>
</tr>
<tr>
<td>Customer Connection Contact Rating</td>
<td>10 Amps Max Contacts</td>
</tr>
<tr>
<td>Ambient Temperature: Operating</td>
<td>-20°C to +60°C [-4°F to 140°F]</td>
</tr>
<tr>
<td>Ambient Temperature: Storage</td>
<td>-40°C to +80°C [-40°F to 176°F]</td>
</tr>
<tr>
<td>Humidity</td>
<td>5 to 85% RH, no condensation</td>
</tr>
<tr>
<td>Weight</td>
<td>51.5 oz., 3.2 lbs. (F.R.U.)</td>
</tr>
<tr>
<td>Industrial Control Equipment</td>
<td>UL 1008 Listed</td>
</tr>
<tr>
<td>Construction</td>
<td>Solid State Circuitry</td>
</tr>
<tr>
<td>Dimensions (W x H x D)*</td>
<td>7&quot; x 10 7/8&quot; x 1 ½&quot;</td>
</tr>
<tr>
<td>Mounting (W x H)*</td>
<td>7 ½&quot; x 7&quot;</td>
</tr>
</tbody>
</table>

* Reference Figure 5.

Microprocessor System Order Guide

<table>
<thead>
<tr>
<th>Part Numbers</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>70LSEMP1850050</td>
<td>Field Replaceable Unit, F.R.U.</td>
</tr>
<tr>
<td>58NPTOL7678000</td>
<td>HMI Overlay for Front of Door</td>
</tr>
<tr>
<td>58NPTOL7678001</td>
<td>Fixed IC, MC Units (w/Modbus RS-485)</td>
</tr>
<tr>
<td>43XYMKP4408300</td>
<td>Keypad</td>
</tr>
<tr>
<td>70LSEMP1857400</td>
<td>Relay Interface Board, RIB</td>
</tr>
<tr>
<td>32IDEC1940001</td>
<td>ICE Cube Relays, 12Vdc, 1 Pole</td>
</tr>
<tr>
<td>32IDEC1940002</td>
<td>ICE Cube Relays, 12Vdc, 2 Pole</td>
</tr>
<tr>
<td>43IDESP1940180</td>
<td>ICE Cube Relays, 12Vdc, Hold Down Spring</td>
</tr>
<tr>
<td>32IDEC1940004</td>
<td>ICE Cube Relays, 24Vdc, 1 Pole</td>
</tr>
<tr>
<td>32IDEC1940005</td>
<td>ICE Cube Relays, 24Vdc, 2 Pole</td>
</tr>
<tr>
<td>43IDESP1940180</td>
<td>ICE Cube Relays, 24Vdc, Hold Down Spring</td>
</tr>
<tr>
<td>70LSEMP1857301</td>
<td>Power Supply Board, PSB</td>
</tr>
<tr>
<td>70LSEMP1858526</td>
<td>Communication Ribbon Cable, IC Units, 100&quot;</td>
</tr>
<tr>
<td>70LSEMP1857526</td>
<td>Communication Ribbon Cable, MC Units, 72&quot;</td>
</tr>
<tr>
<td>02CASTS1673562, Maintained</td>
<td>Standard Control Switches, Keypad Enable, KPE</td>
</tr>
<tr>
<td>02CASPB1673561, Momentary</td>
<td>Override Pushbutton, ORPB</td>
</tr>
<tr>
<td>02CASPB1673561, Momentary</td>
<td>Load Test Switch, LTS</td>
</tr>
</tbody>
</table>

* Reference Figure 5.