

# SoftPLC Series 7000 I/O Driver

## I. INTRODUCTION

The "*ICO7000.TLM*" is a TOPDOC Loadable Module (TLM) that enables the Series 7000 I/O to be used with SoftPLC. The module contains several TOPDOC Loadable Instructions for reading and writing to the Series 7000 I/O.

## II. SERIES 7000 I/O CONFIGURATION

Each *Series 7000* I/O Module must be configured using the *7000 Utility* Software supplied with the modules. This software must be installed on a computer with a Microsoft Windows 95 or better operating system.

Prior to running the software, you will need connect 24vdc to each module and wire the RS-485 communication network to a RS-485/RS-232 converter like the *ICO-7520*. The RS-232 cable will then connect to your Windows computer's serial port. Using the *7000 Utility* software, you will need to set the baud rate to the default of 9600 and scan the RS-485 network for the modules to be configured. Next you will need to assign a unique address to each module (0-255) and set the baud rate and checksum to the desired values. For analog modules, you will also need to set the Data Format and Input/Output range.

## III. SoftPLC DRIVER INSTALLATION

The "*ICO7000*" TLM" must be installed on *SoftPLC*'s flash disk in the "\SPLCZ\IODVR". (SoftPLC version 2.x) or "\SoftPLC\TLM" (SoftPLC version 3.x). This can be done using a FTP Client such as WSFTP. A DEMO version of WSFTP\_PRO is provided on the *SoftPLC* Product CD.

In order for the driver to be selected in the *NexGen* Module Editor, the *ICO7000.2X* (SoftPLC 2.x) or *ICO7000.DEF* (SoftPLC 3.x) file must be installed on the Windows PC in the "\SoftPLC\PLC" directory.

The recommended driver configuration parameters for SoftPLC version 2.x are show below: (For SoftPLC version 3.x, the path will be "\SoftPLC\TLM".)

**MODULE=C:\SPLCZ\IODVR\ICO7000.TLM COMPORT=2 BAUD=1152 TIMEOUT=20 CHECKSUM**

For off-line programming with TOPDOC for *SoftPLC* version 4.x, the *ICO7000.TLM* must be installed on the Windows PC and a "MODULE.LST" file created or modified for TOPDOC. This LST file must reside in the TDZ directory (\TDZ). The keyword "MODULE" should be used to define the type of "driver". If TOPDOC is installed on the "C:" drive, and the TLM is installed in the "\SPLCZ\IODVR" directory, then the following entry would be required in the "MODULE.LST" file:

**MODULE=C:\SPLCZ\IODVR\ICO7000.TLM COMPORT=2 BAUD=1152 TIMEOUT=20 CHECKSUM**

#### IV. DRIVER OPTION PARAMETERS

There are four (4) command line arguments supported by the *ICO7000* module:

1. **COMPORT**=*n* - where **1**=COM1, **2**=**COM2 (default)**, **3**=COM3, or **4**=COM4.
2. **BAUD**=*nnnn* - where **96**=9600, **192**=**19200 (default)**, **384**=38400, **576**=57600, and **1152**=115200 baud.
3. **TIMEOUT**=*nnn* - Adjustable from **5** to **500** msec; **default=40 msec**.
4. **CHECKSUM** - If specified, enables 2 character HEX checksum; **default = not enabled**.

**Note:** *The Series 7000 I/O requires the following communication settings that are preset by the driver (non-configurable): NO Parity, 8 bits, 1 Stop bit.*

## V. RUNTIME TLI'S

The following TLI's are provided to read/write to the Series 7000 I/O Modules. All parameters are integers except where noted specifically as floating point.

1. **I7017** - "Read 8 Analog Values", reads 8 channels in volts/current, percent or HEX format. The format that the module is programmed to use must be declared in Param1. Floating point data types are required for Engineering Units and Percent values and Integer files for HEX data.

Param0 - Module Address (0 - 255)

Param1 - Format of data; 0=Engr, 1=%, 2=Hex.

Param2 - Integer or Float File, length is fixed at 8 elements.

Param3 - Error code

2. **I7018** - "Read 8 TC Inputs"; reads 8 thermocouple channels in Engineering Units (volts), Percent, or HEX format. The format that the module is programmed to use must be declared in Param1. Floating point data types are required for Engineering Units and Percent values and Integer files for HEX data. If Input Channel is set to a T/C type, the Error Channel can be determined and is indicated in Param4.

Param0 - Module Address (0 - 255)

Param1 - Format of data; 0=Engr, 1=%, 2=Hex.

Param2 - Integer or Float File, length is fixed at 8 elements.

Param3 - Error code

Param4 - Error Channel; where bit=1 indicates problem channel.

3. **I7024** - "Write Analog Output"; write a given value to a specified analog output channel.

Param0 - Module Address (0-255)

Param1 - Channel (0-3)

Param2 - Float value to write in Engineering Units (volts/mA)

Param3 - Error code

4. **I7041** - "Read Digital Inputs"; reads 14 digital inputs (source) into a single integer word. By default, no connection or vdc >2 will set the bit ON and the bit will be set OFF when the point is <= 2vdc. The XOR mask is provided to invert the logic in a bitwise fashion; where 0 is no change

Param0 - Module Address (0-255)

Param1 - XOR mask for bitwise state inversion

Param2 - Digital Input state

Param3 - Error code

5. **I7043** - "Write Digital Outputs"; writes to 16 digital output.  
  
Param0 - Module Address (0-255)  
Param1 - Digital Output value  
Param2 - Error code
6. **I7052** - "Read Digital Inputs"; reads 8 isolated digital inputs into a single integer value.  
  
Param0 - Module Address (0-255)  
Param1 - Digital Input state  
Param2 - Error code
7. **I7053** - "Read Digital Inputs"; reads 16 digital inputs (source) into a single integer value. By default, no connection or vdc >2 will set the bit ON and the bit will be set OFF when the point is <= 2vdc. The XOR mask is provided to invert the logic in a bitwise fashion; where 0 is no change.  
  
Param0 - Module Address (0-255)  
Param1 - XOR Mask for bitwise state inversion  
Param2 - Digital Input state  
Param3 - Error code
8. **I7060** - "RD/WR Digital I/O"; reads 4 digital Inputs and writes 4 digital outputs. Input states are inverted; where no connection equals bit value of 0.  
  
Param0 - Module Address (0-255)  
Param1 - Digital Output value  
Param2 - Digital Input state  
Param3 - Error code
9. **I7065** - "RD/WR Digital I/O"; reads 4 digital Inputs and writes 5 digital outputs. Input states are inverted; where no connection equal bit value of 0.  
  
Param0 - Module Address (0-255)  
Param1 - Digital Output value  
Param2 - Digital Input state  
Param3 - Error code
10. **I7RDC** - "Read Digital Input Counter" reads a 16 bit Counter value associated with a single bit in the following digital input modules: 7041, 7044, 7050, 7052, 7053, 7060, 7063, and 7065. Since the counter range is 0 to 65535 decimal, it is recommend that the value be read into a float element rather than an integer.  
  
Param0 - Module Address (0-255)  
Param1 - Counter Channel (0-15)  
Param2 - Count value (Integer or Float)  
Param3 - Error code

11. **I7CDC** - "Clear Digital Input Counter"; clears a 16 bit counter value associated with a single bit in the following digital input modules: 7041, 7044, 7050, 7052, 7053, 7060, 7063 and 7065.  
Param0 - Module Address (0-255)  
Param1 - Counter Channel (0-15)  
Param2 - Error Code
  
12. **I7RDMS** - "Read Module Status", reads module status or operational mode byte; where:  
00h = *Normal Mode*, Watchdog feature not enabled  
04h = *Safe Mode*, Watchdog timed out, Outputs set to Safe Value  
80h = *Watchdog Mode*, Watchdog feature enabled.  
  
Param0 = Module Address (0-255)  
Param1 = Status Byte (00h, 04h , or 80h)  
Param2 = Error Code
  
13. **I7RSMS** - "Reset Module Status", resets module operation (status) to Normal Mode (00h).  
  
Param0 = Module Address (0-255)  
Param1 = Error Code
  
- 14.. **I7SHWV** - "Set Host Watchdog Value", If current operation is Normal Mode (00h), sets watchdog timeout value and enables WatchDog Mode (80h). This TLI should be executed after **I7RSMS**.  
  
Param0 = Module Address (0-255)  
Param1 = Watchdog value in 0.1 seconds (1-255).  
Param2 = Error Code
  
15. **I7HOK** - "Host OK", Broadcast signal to reset watchdog timer on all output modules on the network. In Watchdog Mode, this TLI must be executed before the watchdog expires to keep a module operational and prevent module Safe Value lock .  
  
Param0 = Error Code

## VI. **POSSIBLE ERROR CODES**

- 1001 - Invalid Comm Port number
- 1002 - Invalid command line argument
- 1003 - Invalid timeout value given
- 1004 - Unable to open Comm Port
- 1005 - No response within Timeout value
- 1006 - Invalid command; '?' received from module!
- 1007 - Invalid module address
- 1008 - Invalid length; response exceeds internal string buffer size!
- 1009 - Invalid baud rate specified
- 1010 - Selected Comm Port is closed
- 1011 - Invalid checksum; received bad!
- 1012 - Received Ignore command from module
- 1013 - Invalid command format
- 1014 - Invalid Data Format sent or received
- 1015 - Invalid Data Format requested by user (0-2 only!)
- 1016 - Invalid Channel Number
- 1017 - Declared data format does not match module programming
- 1018 - Invalid Data Value encountered, value set to zero.
- 1019 - Invalid Watch Dog Value
- 1020 - Command is not supported

## VII. PERFORMANCE

1. The driver was tested from 9600 to 115200 baud with following response times in milliseconds:

<u>TLI</u>	<u>9600</u>	<u>19200</u>	<u>38400</u>	<u>57600</u>	<u>115200</u>	
I7017	50	25	13	10	5	format=2; Hex
I7018	75	38	20	15	8	format=0; Temp
I7024	16	8	4	3	2	
I7041	16	8	4	3	2	
I7052	16	8	4	3	2	
I7060	34	17	9	6	3	
I7065	34	18	9	6	3	

2. The wireless modems, *ICO-SST2400EXT* and *ICO-SST2450EXT* were also tested. It was found that if the wireless broadcast is RS232 (MASTER to SLAVE), that the maximum baud rate is limited to 19200 (SST2400) or 9200 (SST2450) baud with an effective baud rate of 4800/2400 respectively due to a communication delay in the wireless processing of approximately 16 milliseconds. However, if the wireless broadcast is RS-485 (SLAVE to SLAVE), higher through-put is realized. This is primarily due to two factors, the first being that a higher baud rate of 38,400 may be selected and the wireless delay is lower at 12 milliseconds. As a result, the overall effective baud rate is higher at approximately 19,200 baud.

Multiple Slaves may also be used on the I/O side. Each 2450 wireless slave should be set to the same P/N and Channel numbers. However, I/O module node addresses must be unique over the span of the network, no duplicates!

It is recommended that the wireless modems be inserted in the RS-485 circuit and set-up in *Mode 3* as follows:

SLAVE, RS485, Half-Duplex, Sync, 38.4 Kb, N, 8, 1, P/N=0, CH=0.

The serial communication diagram would look as follows::

```
SoftPLC <RS232> 7520 <RS485> 2450 <-) ((-> 2450 <RS485> <I/O Modules 1-8>
                                         ((->2450 <RS485> <I/O Modules 9-x>
                                         ...
```