
Triangle MicroWorks, Inc.
IEC 60870-5-103 Slave
Source Code Library

What's New?

a description of the changes included in all versions of the library

Version 3.13.00
November 17, 2011

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This document describes features or corrections that have been added to the IEC 60870-5-103 Slave Source Code Library.





The symbols to the left of each revision are used to help define the following kinds of revisions:


- 103** Additional IEC 60870-5-103 Features, giving the Library support for more IEC 60870-5-103 objects or functions.
-  Additional Implementation Features, allowing implementers to more efficiently install the Source Code Library.
-  Corrections to problems, with indications for when the problems were introduced.


Version 3.13.00 (November 17, 2011)


-  Modified 56-bit time decoding so that years 70-99 assume 1970-1999 instead of 2070-2099
-  Corrected a warning caused by an uninitialized structure in LinIOTarg RS232 implementation.
-  Provided big endian get and put functions.
-  *Description:* LinIOTarg could access channel structure members after marking a channel for deletion.
Introduced: v3.07
Resolution: Fixed in v3.13


Version 3.12.00 (July 7, 2011)


-  Added additional functionality for managing external time synchronization.
-  Added TMWYPES_ANALOG_TYPE_DSCALED that lets database return Double and Long value. This feature provides more flexibility to the outstation for handling rounding.
-  *Description:* The source code library only checked the Information Number (and not the ASDU number) when applying Blocking Mode.
Introduced: v3.00
Resolution: Fixed in v3.12
-  *Description:* The timer callback may continue to loop if a very short timer is added in the timer callback.
Introduced: v3.00
Resolution: Fixed in v3.12

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Description: tmwvertime_addOffset did not follow 0 -599999 rule.
Introduced: v3.00
Resolution: Fixed in v3.12
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Description: Some compilers issued warnings when a break followed a return (e.g., in tmwphysd.c).
Introduced: v3.00
Resolution: Fixed in v3.12
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Description: In function tmwmem_lowlnit(), a failure to allocate memory resulted in a return with no indication to the caller that a failure occurred.
Introduced: v3.00
Resolution: Fixed in v3.12
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Description: The link layer incorrectly assumed that unconfirmed data was a broadcast message.
Introduced: v3.00
Resolution: Fixed in v3.12
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Description: LinIOTarg computed date incorrectly when converting a "struct tm" to TMWDTIME.
Introduced: v3.07
Resolution: Fixed in v3.12


Version 3.11.00 (October 1, 2010)


No updates to IEC 60870-5-103 Slave Source Code Library in this release.


Version 3.10.00 (August 25, 2010)


No updates to IEC 60870-5-103 Slave Source Code Library in this release.

Version 3.09.00 (March 15, 2010)


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Modified WinIOTarg to prefer an exact address match when multiple channels are open and disconnectOnNewSyn==true.
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Added localIpAddress to WinIoTarg to specify the source address to use when Client (or UDP sender) is sending IP messages. This, in conjunction with the Destination IP address and Routing Tables allows control over which Ethernet card is used to establish a connection. (At Windows command prompt, enter "route print" "route add xxx" can be used to add a route to cause a particular NIC to be used.)
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Enhanced WinIOTarg to support a list of addresses from which TCP/IP connections will be accepted.
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Added user data pointers to TMWCHNL, TMWSCTR, and TMWSESN.

 *Description:* When multiple application contexts are used, closing one deleted the memory pool lock, which could cause problems if another application context was open.


Introduced: v3.00

Resolution: Fixed in v3.09

 *Description:* WinIOTarg could fail to process all available characters, causing timeouts when running at high baud rates.


Introduced: v3.00

Resolution: Fixed in v3.09

 *Description:* When configured to use system time, WinIOTarg System time not setting the dstInEffect flag correctly.


Introduced: v3.00

Resolution: Fixed in v3.09

 *Description:* LinIOTarg could cause high levels of processor utilization when multiple channels were opened.


Introduced: v3.07

Resolution: Fixed in v3.09

 *Description:* The Source Code Library attempted to process a second command while the first command was still executing.

Introduced: v3.00

Resolution: Fixed in v3.09

 *Description:* If the cyclic period was too short, not all points would get sent in cyclic messages.

Introduced: v3.00

Resolution: Fixed in v3.09

Version 3.08.00 (September 25, 2009)

 *Description:* The rs232Reader thread in WinIOTarg was missing a stop event.

Introduced: v3.00

Resolution: Fixed in v3.08

Version 3.07.00 (July 17, 2009)



Added LinIOTarg (low-level target for Linux) and new command line-based examples (that can be used with Linux).





Integrated WinIOTarg (low-level target for Windows) into the standard release package.



Added FormatMessage Win32 API function to WinIoTarg to provide more descriptive errors instead of just numeric values.

Version 3.06.00 (April 14, 2009)

-  Added TMWCNFG_MAX_APPLRCVS to “break out” of loop in tmwappl_checkForInput() after the specified number of iterations.
-  Modified timer values in tmwlink_channelCallback to speed up retries.



Version 3.05.00 (December 4, 2008)

No updates to IEC 60870-5-103 Slave Source Code Library in this release.

Version 3.04.01 (September 30, 2008)

-  Improved comments on compiler options such as TMWCONFIG_USE_MANAGED_SCL.

Version 3.04 (September 12, 2008)

-  *Description:* s103read (an Areva private command) did not set ACD bit.
Introduced: 3.0.45
Resolution: Fixed in v3.04
-  *Description:* tmwdb_lockQueue and tmwdb_unlockQueue were described in the header comments for tmwdb_storeEntry in tmwdb.h, but they were not defined in tmwdb.c.
Introduced: v3.00
Resolution: Fixed in v3.04


Version 3.03.00 (April 1, 2008)

-  Added ability to include session indicator in channel statistics.


Version 3.02.00 (December 7, 2007)

No updates to IEC 60870-5-103 Slave Source Code Library in this release.


Version 3.01.01 (July ??, 2007)

-  Added ability to keep time on a per-session basis. Added pSession to tmwdtime structure; target layer can use this parameter to return a time specific to the session.



Version 3.01.00 (May 23, 2007)

-  Modified online notification algorithm to facilitate notification of sessions that never go online.




Version 3.00.49 (November 1, 2006)

-  Renamed TMWCHNL_STAT_CALLBACK and TMWSESN_STAT_CALLBACK macros to TMWCHNL_STAT_CALLBACK_FUNC and TMWSESN_STAT_CALLBACK_FUNC. This change avoids having a macro and a typedef with the same name.





Version 3.00.46 (April 27, 2006)

-  Modified release to include WinIoTarg.dll built with Visual Studio 6. This DLL is used when using Visual Studio to build the sample applications.
-  Updated sample Makefiles to correctly build Source Code Library.

Version 3.00.45 (March 17, 2006) 🍀

-  Added support for Areva custom ASDUs.
-  Added support for Siemens SIPROTEC private ASDU 205.
-  Added channel call to error call in i870dia1_linkAddressUnknown.



Version 3.00.44 (February 2, 2006)


-  Added a sample application to provide an example of a multi-threaded, event-driven application.
-  Set receive indication in diagnostic information to indicate the direction of the message.
-  Enhanced statistics to include additional values such as CRC errors, number of invalid start bytes, frame length errors, etc.
-  Split into tmwtarg.h/c into tmwtarg.h/c and tmwtargp.c/c. This change moves all Triangle MicroWorks, Inc. specific code into a separate file. Customers only need to modify tmwtarg.c.

Version 3.00.43 (December 2, 2005)



-  Improved display of device identification in the protocol analyzer log.

Version 3.00.42 (September 9, 2005)





-  Improved documentation by updating *IEC 60870-5-103 Slave.doc* to improve readability and include all user-modifiable files.
-  Added subversion to SCL filename (e.g., s103v30042.exe). This allows the version number to be determined from the file name. The version number continues to be defined in tmwvrsn.h.

-  *Description:* The Source Code Library could potentially reference a Null pointer in `tmwdlist_removeEntry`
Introduced: v3.00
Resolution: Fixed in v3.00.42





Version 3.00.41 (July 20, 2005)


-  Added support for broadcast messages for time sync, general interrogation, and general command.
-  *Description:* A General command issue to a Double Point that had been removed could cause a crash. General Command points and Double Points are now added and removed together.
Introduced: v3.0
Resolution: Fixed in v3.00.41

Version 3.00.40 (June 3, 2005)



-  Added 103Slave sample application executables and required DLLs to allow running this application without having to build it.
-  Improved documentation of memory type configuration.
-  Fixed compiler warning for `TMWTYPES_BOOL` type.
-  *Description:* `TMWMEM_FREE_FUNC` was doubly defined.
Introduced: v3.00.39
Resolution: Fixed in v3.00.40

Version 3.00.39 (March 29, 2005)

-  Improved memory management within Source Code Library. Added new `#define` (`TMWCNFG_ALLOC_ONLY_AT_STARTUP`) to `tmwcnfg.h`. Also added new functions that target to set the maximum number of each buffer in each pool at runtime. Both “only at startup” and static allocations use a linked list of free and allocated buffers instead of just an array that was accessed sequentially.
-  Added description and example of custom ASDU support to User Manual.
-  Added `TMWSCTR_STAT_EVENT_NOTFULL` statistic to indicate that the event queue is no longer full. This provides the target the ability to use a pseudo point to indicate event buffer overflow conditions.
-  *Description:* The Source Code Library did not handle Link Resets properly.
Introduced: v3.00
Resolution: Fixed in v3.00.39

-  *Description:* s3sim_msrndAddPoint() and s3sim_msrn2AddPoint() used incorrect data types.
Introduced: v3.00
Resolution: Fixed in v3.00.39

Version 3.00.38 (January 18, 2005)

-  Modified the API for the channel, session, sector modify functions to initialize a structure with the current settings. Any of these settings may then be modified by the target code.
-  *Description:* The Source Code Library did not properly handle a General Interrogation (GI) received while responding to a previous GI.
Introduced: v3.00
Resolution: Fixed in v3.00.38




Version 3.00.37 (December 15, 2004)

No updates to IEC 60870-5-103 Slave Source Code Library in this release.


Version 3.00.36 (November 2, 2004)


No updates to IEC 60870-5-103 Slave Source Code Library in this release.

Version 3.00.35 (September 22, 2004)

-  Added #define TMWCNFG_MEMORY_ALIGN_NEEDED to tmwcnfg.h to support processors requiring long word (4 byte) alignment and compilers that create unpacked structures.
-  Added tmwapp_startTimer and tmwapp_cancelTimer to tmwtarg.c.
NOTE: These functions must be defined in the target in order for the Source Code Library to link.
-  *Description:* The Source Code Library would respond to Class 1 or 2 poll requests before receiving the Reset FCB or Reset CU message.
Introduced: v3.00
Resolution: Fixed in v3.00.35


Version 3.00.34 (July 30, 2004)

-  Added new interface function to determine the COT and information number to send in an Identification ASDU.

 *Description:* The Source Code Library could call `tmwtarg_startTimer` with a negative value. For some operating systems, this causes timers to stop running.


Introduced: v3.00.32

Resolution: Fixed in v3.00.34

 *Description:* The algorithm for sorting timers did not work properly if the two times being compared were more than 17 days apart.

Introduced: v3.00

Resolution: Fixed in v3.00.34

 *Description:* `i870util.h` was sometimes included as `I870util.h`, causing compilation problems with some compilers.

Introduced: v3.00

Resolution: Fixed in v3.00.34

Version 3.00.33 (June 17, 2004)

No updates to IEC 60870-5-103 Slave Source Code Library in this release.

Version 3.00.32 (June 4, 2004)



Enhanced `s103msrnd` and `s103msrnd2` to set the value, invalid flag, and overflow flag separately.



Description: The Source Code Library responded to a time synchronization command with the incorrect value.

Introduced: v3.00

Resolution: v3.00.32



Description: A 31-day timer would expire immediately.

Introduced: v3.00

Resolution: Fixed in v3.00.32


Version 3.00.29 (May 24, 2004)



Enhanced support for multiple threads. Added support for one timer queue per channel. Also improved locking/unlocking to prevent threads from being interrupted or deadlocked. This enhancement required two changes to the API:


- Added new `#define(TMWCNFG_MULTIPLE_TIMER_QS)` to allow support of multiple timer queues (default is `TMWDEFS_FALSE`)
- Added new parameter to `tmwdb_storeEntry()` to indicate whether the queue should be locked (default is not to lock the queue).

Any implementation using multiple threads should upgrade to this release

 *Description:* The `_timerCallback` function in `tmwtimer.c` did not always lock the proper channel.

Introduced: v3.00

Resolution: Fixed in v3.00.31

 *Description:* The Source Code Library did not calculate the first byte time correctly for variable and fixed length frames.

Introduced: v3.00


Resolution: Fixed in v3.00.31


 *Description:* `tmwappl_initApplication()` could not be called more than once.

Introduced: v3.00.29

Resolution: Fixed in v3.00.31

Version 3.00.29 (March 31, 2004)


 Added ability to specify whether the Source Code Library should automatically issue an event for an operation acknowledgement. If the event is not sent automatically by the Source Code Library, it can be requested by the application.

 Modified order of data type transmission in responses.

 *Description:* The Source Code Library did not calculate times correctly


Introduced: v3.00.27

Resolution: Fixed in v3.00.29

 *Description:* The Source Code Library could send a response to a Clock Sync message before all time tagged data had been sent.

Introduced: v3.00


Resolution: Fixed in v3.00.29

 *Description:* When configured for Static memory support, the Source Code Library could fail to allocate buffers if they contained non-zero data on startup.

Introduced: v3.00.23


Resolution: Fixed in v3.00.29

Version 3.00.28 (March 2, 2004)

 *Description:* The Source Code Library could attempt to access a Null pointer if the Link Address Size was configured to 0.

Introduced: v3.00

Resolution: Fixed in v3.00.28

-  *Description:* Application Layer messages were not removed from the queue when the Link Layer timed out.
Introduced: v3.00
Resolution: Fixed in v3.00.27

Version 3.00.27 (February 3, 2004)

No updates to IEC 60870-5-103 Slave Source Code Library in this release.

Version 3.00.26 (January 15, 2004)

No updates to IEC 60870-5-103 Slave Source Code Library in this release.





Version 3.00.25 (December 12, 2003)

No updates to IEC 60870-5-103 Slave Source Code Library in this release.



Version 3.00.24 (November 10, 2003)


No updates to IEC 60870-5-103 Slave Source Code Library in this release.


Version 3.00.23 (October 31, 2003)


-  Added locks to tmwmem.c to add support for multiple threads to memory management routines.
-  Provided optimizations when diagnostics are not compiled in.
-  *Description:* The Source Code Library could reference a Null pointer when adding events if the device was out of memory and there were no events on the current event queue.
Introduced: v3.00
Resolution: v3.00.23
-  *Description:* The Source Code Library did not deallocate the txData structure when using a serial link and the confirm was not received.
Introduced: v3.00
Resolution: v3.00.23


Version 3.00.22 (October 8, 2003)


-  Added support for ASDU 123 to support Procome Specification.
-  Added S13data_dataReady() function to provide ability for target layer to indicate that database accesses are not ready. If s13data_dataReady returns TMWDEFS_FALSE, the Source Code Library will return ACTCON to the current command and wait until the database is ready.


 The Source Code Library no longer generates an error when it receives a message it sent. This change facilitates use on a fiber optic ring.

 Changed the interface to s13_xxxChanged() functions to remove the time stamp, since the Source Code Library sets the time stamp. If the application needs to specify the time stamp, it should call s13xxx_addEvent() instead of relying on scanning.

 Improved detection of sessions going offline. Any application layer error will now take a session offline.


 Cyclic Data are now sent as part of initialization.

 Added pCheckAddrCallbackFunc function. This function facilitates the use of modem pools with the Source Code Library.

 *Description:* Some functions called i870chnl_newTxData without checking to see if it returned Null.

Introduced: v3.00


Resolution: Fixed in v3.00.22. The SCL now checks for a Null pointer return from all calls to i870chnl_newTxData.


 *Description:* The txData structure was not deallocated for a Generic Services event if Blocking Mode was enabled.

Introduced: v3.00

Resolution: Fixed in v3.00.22

Version 3.00.20 (September 2, 2003)

 Added callback function to let target application know when a channel is idle and can be disconnected.


 An evaluation version of a working sample of a Windows application is now shipped with the Source Code Library. The evaluation expires after running for two hours.

 *Description:* If TMWCNFG_SUPPORT_DOUBLE wasn't supported, compilation issues would occur.

Introduced: v3.00

Resolution: Fixed in v3.00.20

Version 3.00.19 (August 8, 2003)

 *Description:* The Source Code Library could call tmwtarg_startTimer even if the timer was already running. This issue only affected event driven implementations (i.e., implementations that did not use the polled timer implementation).






Introduced: v3.00

Resolution: Fixed in v3.00.19








Version 3.00.18 (July 22, 2003)

No updates to IEC 60870-5-103 Slave Source Code Library in this release.

Version 3.00.17 (July 10, 2003)

-  Added Sector statistics callback function and provided event buffer overflow indication.
-  Implemented reset user link layer function code in FT1.2.
-  Improved implementation of internal data passed to callback functions to return a well defined structure and status codes.
-  Added TMWTARG_CONFIG structure to allow specification of parameters that are common to multiple protocols.
-  *Description:* Closing a sector attempted to deallocate the same memory more than once.
Introduced: v3.00
Resolution: Fixed in v3.00.17

Version 3.00.16 (June 19, 2003)

-  Added limit checks for sprintf statements. This prevents buffer corruption caused by writing past the end of the current buffer.
-  Modified Source Code Library to avoid string copies for diagnostics when the diagnostics aren't enabled.
-  Restructured Source Code Library to allow Master and Slave sessions on a channel simultaneously to support Peer or Dual mode. Removed p10x files.
-  Added current version number to *tmwvrsn.c/h* in the *utils* directory to simplify determining which version of the Source Code Library is in use.
-  Improved Protocol Analyzer display to use terminology from standards documents; now display "SQ" instead of "SEQ" for Single/Sequence bit.
-  Cleaned up compiler warnings and issues identified by *lint*.
-  *Description:* The Source Code Library could crash when processing Type 2 data with the Invalid flag set.
Introduced: v3.00
Resolution: Fixed in v3.00.16

Version 3.00.15 (May 27, 2003)

No updates to IEC 60870-5-103 Slave Source Code Library in this release.

Version 3.00.14 (May 9, 2003)



Improved memory management. Implemented a new memory management scheme that supports static memory as well as providing limits on the number of each type of structure that can be allocated. It also provides details on how many structures of each type have been allocated and keeps track of the maximum number that was allocated. This provides feedback that can be used in sizing applications and monitoring allocated memory. Cleaned several areas in which memory was not being freed properly.

Version 3.00.12 (April 28, 2003):



Added Incremental Application Layer Response Timeout configuration parameter.



The Incremental Timeout timer is now disabled if the timeout value is set to zero



Description: The Source Code Library could reference unallocated memory and cause a crash if Link Layer Confirms were enabled and the Application Layer timeout was configured to be less than ((Link Layer timeout) * (number of Link Layer retries+1)).

Introduced: Version 3.00

Resolution: Fixed in version 3.00.12. When the Application Layer times out, it now tells the Transport Layer, which in turn tells the Link Layer.

Version 3.00.11 (April 24, 2003):



If a connection is broken or the remote device restarts, the Source Code Library will attempt to reopen the connection.



The maximum number of events is now configurable. See *tmwcnfg.h*



Add support for Send /No Reply in monitoring direction.

Version 3.00 (April 28, 2003):



The Triangle MicroWorks, Inc. Source Code architecture was redesigned and reimplemented to follow modern software engineering practices and leverage new techniques in software design. We have also incorporated suggestions from our existing customer base. The main advantages to this redesign include:

- 1) Common source code architecture across all TMW libraries - The use of a common architecture across all libraries significantly reduces time required to port additional protocols to a target device. In addition, using common software across all products results in better code, since common functions are utilized much more frequently than protocol specific functions.
- 2) Source Code Library calling routines are now compatible with a wider variety of event driven techniques, allowing the target application to be achieve higher performance.
- 3) Most configuration parameters are now passed as arguments in Source Code Library function calls instead of macros. This allows for data hiding and protects configuration parameters from accidentally being changed while the Source Code Library is running. In addition, macro calls to target hardware and the database interface routines were replaced with function calls.
- 4) Significant reduction in the time to implement new features - In addition to being more flexible, the use of modern software design practices significantly reduces the time required for Triangle MicroWorks to support new features. As the existing protocols are constantly being improved by the associated Technical Committees and Working Groups, it is essential that the Source Code Libraries are able to remain up to date with the latest standards.

Version 2.13 (July 10, 2002):



Removed **S103CNFG_LINK_SUPPORT_BALANCED()** and **S103CNFG_LINK_SUPPORT_UNBALANCED()** from **s103cnfg.h**. Now both are supported at all times.



Fixed bug when a invalid command was received and was not handled correctly by the slave. Now the correct status of the invalid command is returned in a response.

Version 2.11 (January 31, 2002):



Fixed a bug that caused immediate retries if a message was not transmitted immediately (i.e. **S103TARG_COMM_TRANSMIT_READY** macro returns false and/or **S103CNFG_PHYS_TX_DLY** greater than 0). The link layer would incorrectly assume the confirm timeout has expired and try to retransmit the message immediately.



Added initialization of **firstCharWait** timer and changed call from **S103TARG_COMM_CLOSE()** to **tmwphys_closeChannel()** to properly close channels. Introduced in version 2.02.



Fixed bug with `S101CNFG_PHYS_TX_DLY()` which would not allow transmission if this macro was defined as zero.



Don't set the `DIR` control bit when operating in unbalanced mode.

Version 2.06 (September 4, 2001):



Fixed compile time errors when `S103CNFG_LINK_SUPPORT_UNBALANCD()` is set false or when `S103TARG_DIAG_FEATURE_MASK()` is set to zero. Introduced in initial release.

Version 2.05 (August 31, 2001):



Fixed a bug that returned the incorrect point function code for 103 events. Introduced in initial release.

Version 2.04 (July 26, 2001):



Initial release of the IEC 60870-5-103 Slave Source Code Library.