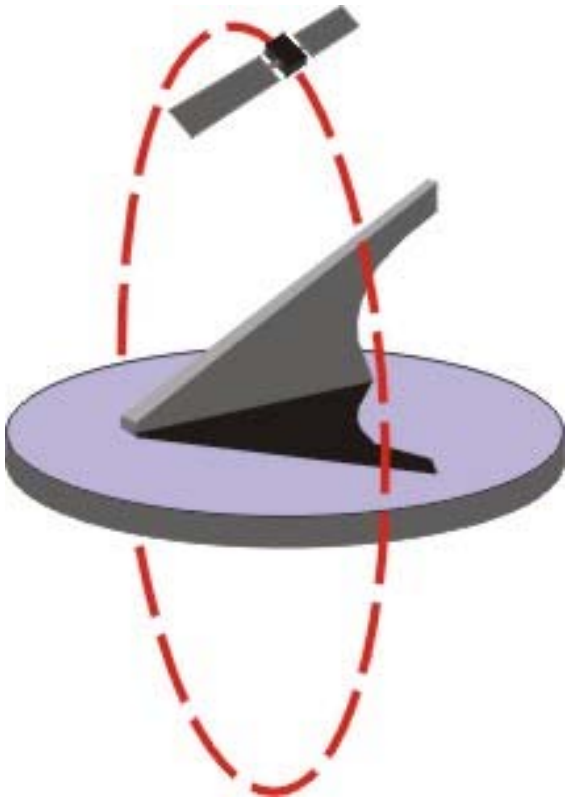
hiprom technologies

1771HP-GPS

USER MANUAL



Rev 5.0 – Sept 2005

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CHAPTER 1 INTRODUCTION

Hiprom presents a Global Positioning System (GPS) based Time-Stamping Input module for the Allen-Bradley PLC5.

The 1771HP-GPS module provides precision time-stamped events of both the 16 external Inputs and 16 internal PLC bits.

This document serves to describe the functionality, installation, configuration and use of the module.

CHAPTER 2 MODULE ACCESSORIES

Each 1771HP-GPS package includes the following components:

- **1771HP-GPS module**
- **5m RG58 patch lead with a SMA male and TNC male connector on either end**
- **3.3V active 50Ω hard mount antenna**
- **1771HP-GPS user manual**
- **HTSB bus cable**

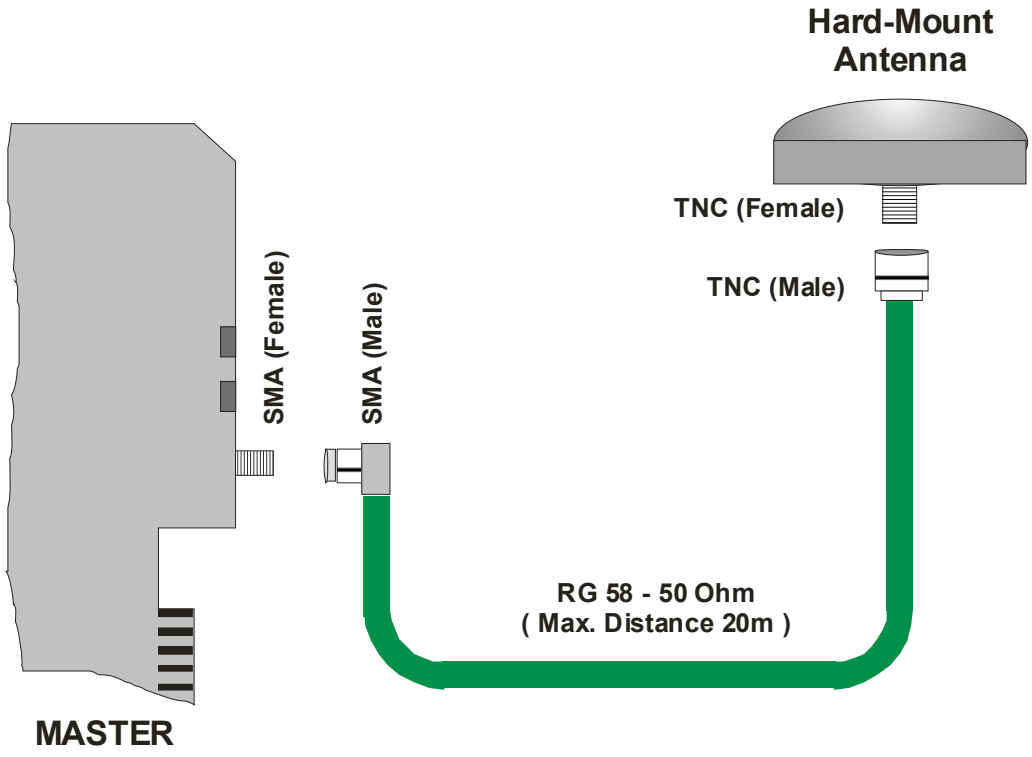


Figure 2.1 : 1771HP-GPS module with antenna and patch-lead

CHAPTER 3 MODULE OPERATION

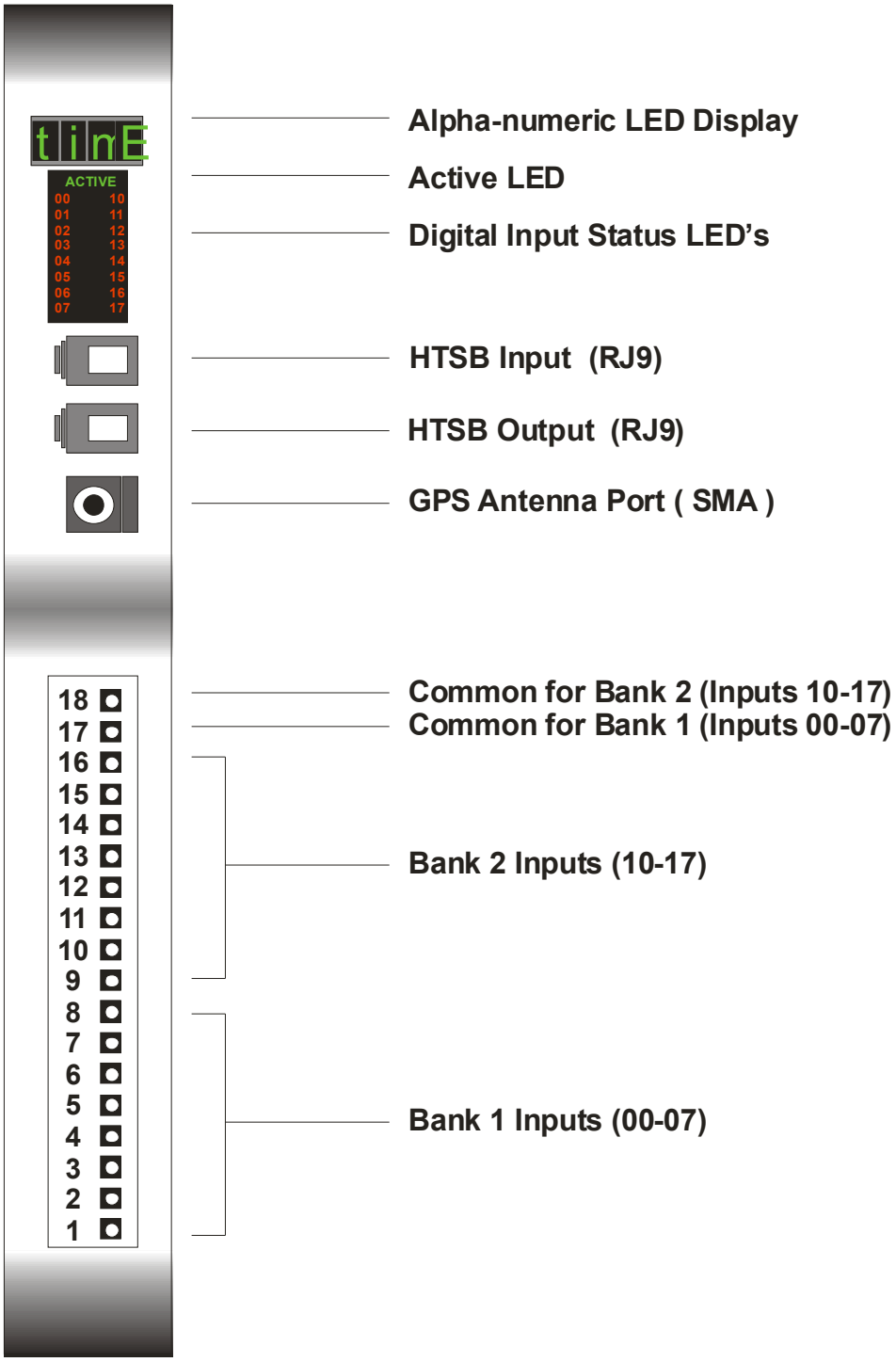


Figure 3.1 : 1771HP-GPS Layout

The 1771HP-GPS module makes use of the Global Position System (GPS) to provide accurate time-stamping of PLC and external events.

Events are triggered by a change in either :

One or more of the external 16 digital inputs, (External)
Or one or more bits in the module's PLC output image. (Internal)

External Inputs

The 16 external inputs are arranged in 2 banks of 8 channels each. These banks are electrically independent from each other having their own commons. The inputs are optically isolated and available in either 24Vd.c. or 110Vd.c.

Digital Filtering

In order to prevent unnecessary events from being triggered due to contact bounce etc. Each external input is digitally filtered. Once an event has triggered on a specific input it is ignored for the duration of the filter constant. This filter constant is common for all 16 channels and can be configured by the use of a BTW instruction. The default value is 10ms.

Internal Inputs

Events are also triggered by a transition of any one or more of the 16 internal memory bits. These bits occupy the second word of the module's PLC output image.

Event Processing

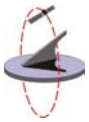
Each event that is triggered is logged to the Event Buffer within the 1771HP-GPS module. This Event Buffer which can store up to 1000 events operates in a First-In-First-Out mode.

Each entry in the Event Buffer stores the following information pertaining to that specific event :

Type (External / Internal)
Date
Time
Validity of Time-Stamp
Snapshot of Inputs
Trigger Mask (Cause of the Event)

If there is an unread event in the Event Buffer the 1771HP-GPS module notifies the PLC by raising a flag (RBT) located in the module's PLC input image.

The user's PLC software should monitor this flag, and when ready, execute a Block Transfer Read (BTR) instruction to read the event.



Once the event is successfully transferred to the PLC by means of the BTR instruction it is removed from the module's Event Buffer.

Should the Event Buffer still contain an event the RBT flag will remain set and a further BTR should be executed. Once the Event Buffer is empty the RBT flag will be cleared and subsequent event BTR's should not be attempted.

Master / Slave Topology

The precise time-stamping in the module is achieved by synchronisation with the GPS satellite system.

The 1771HP-GPS-Master module has an on-board GPS receiver providing time-synchronisation information to not only itself, but to other adjacent slaves by means of the HTSB output port. The -Master module must be connected to an antenna positioned with an unimpeded view of the sky.

The 1771HP-GPS-Slave module relies on a -Master module in close proximity for time synchronisation via its HTSB input port. Each -Slave module echos the HTSB signal to its own HTSB output port to be used by the next -Slave module if required.

Time

Once the module has successfully synchronised or locked onto the satellite system it is able to render precise time-stamping. Until this state has been achieved the status TNS flag (Time Not Sync'ed) will be set, and all events generated during this time will be labelled with the flag signifying a questionable event time-stamp.

On power-up the module defaults to the Universal Time Coordinate (UTC) - defining the local solar mean time at the Greenwich Meridian (GMT). However, the module's time-zone can be configured by means of a Block Transfer Write (BTW) instruction, setting the UTC offset, that is, the difference between the required local time standard and GMT. Some examples are listed in the Appendix.

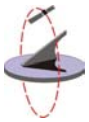
The module's Time Zone should only be setup on power-up and in the case of daylight-saving changes.

Block Transfers

When a Block Transfer (BT) instruction is issued to the 1771HP-GPS it determines the nature of the transfer by the size of the BT.

Allowable BT's and their sizes are as follows :

BTR5
Block Transfer Read of Length 5
- Read / Unload event from Event Buffer



BTR7
Block Transfer Read of Length 7
- Read Module's Status and Time

BTR9
Block Transfer Read of Length 9
- Read Module's GPS Position and Velocity

BTW3
Block Transfer Write of Length 3
- Configure Module

CHAPTER 4 INSTALLING THE MODULE

Install the module

- Make sure the PLC system power is off.
- Slot the 1771HP-GPS module into an available slot. The module is designed for Half-Slot addressing, although it can be used in a Single-Slot configuration if the module is inserted in an odd slot and the slot to the left of the module is left open.
- For Master Modules connect a suitable GPS antenna to the antenna port. Make sure the GPS antenna has an unobstructed view of the sky.
- For Slave modules connect the HTSB input port to the HTSB output port of an adjacent Master module or Slave module which in turn is connected a Master.
- Connect the field cables to the wiring-arm, and slide it onto the module.
- Apply power to the PLC system

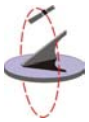
NOTE: Should a longer patch lead be required it is recommended that a GPS signal booster is used. Contact your local Hiprom distributor for assistance.

Once the module has been power up for the first time, it will search for satellites from a cold start (i.e no almanac). The module will take approximately 5 minutes to acquire Lock. Once a complete almanac has been downloaded, the time to achieve fix will be reduced to around 45 seconds.

MASTER / SLAVE CONFIGURATION

Slave modules are connected to adjacent -Master or other -Slave modules by means of an HTSB bus-cable.

All 1771HP-GPS modules, both -Master and -Slave, are equipped with an HTSB input and output port. Take care in ensuring that the HTSB Output port (lower) of the -Master module is connected to the HTSB Input port (upper) of the next -Slave module. Incorrect connection of the HTSB bus cable could result in permanent damage to the module.



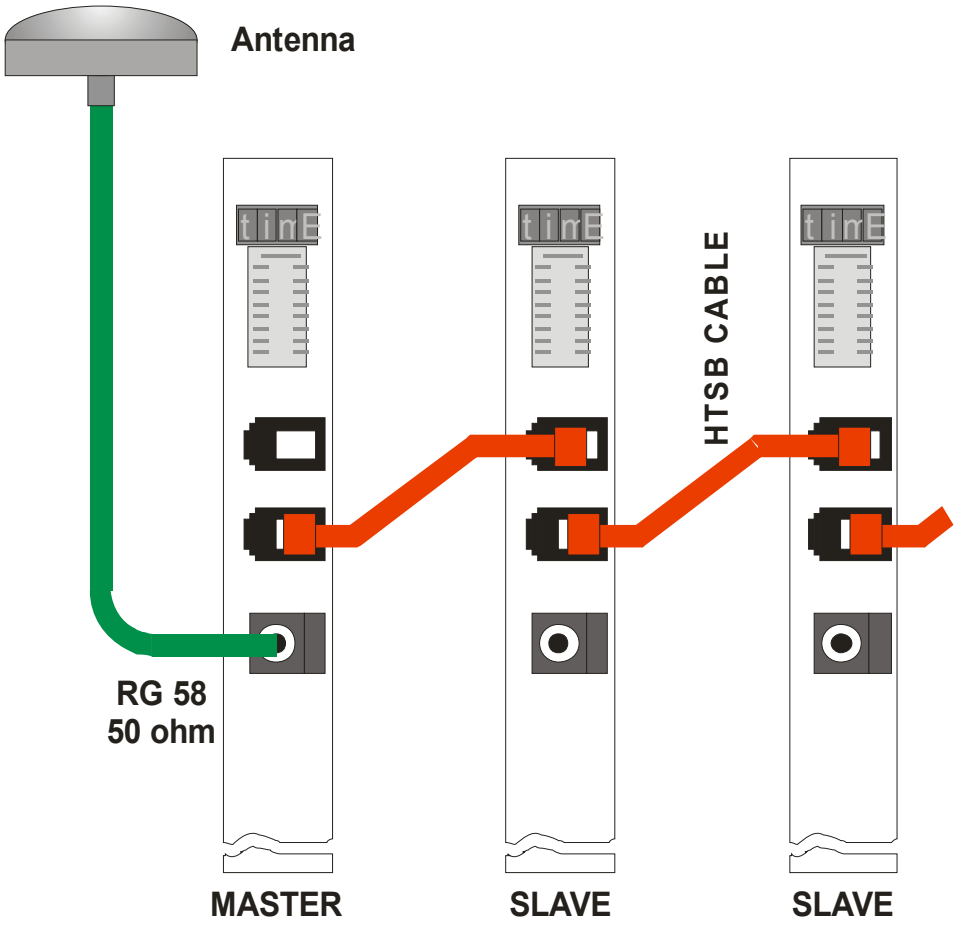


Figure 4.1 : 1746HP-GPS Master / Slave setup

HTSB BUS CABLE

The HTSB cable consists of 4 cores terminated on either side with RJ-9 connectors.

The cable should not exceed 1 metre in length and should not be exposed to high electrical noise environments.

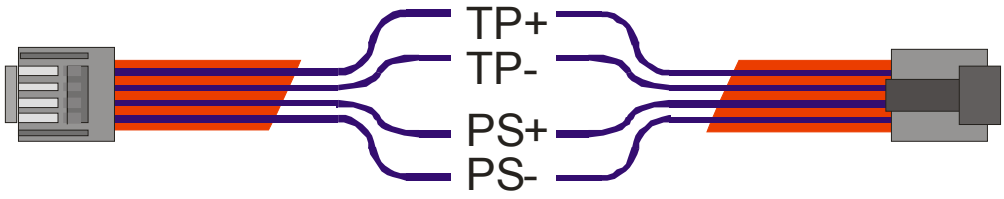


Figure 4.2 : HTSB Bus cable

CHAPTER 5 I/O ADDRESS MAP

The input and output image of the 1771HP-GPS module is defined in the following sections.

5.1 INPUT IMAGE

The data received via input image is dependent on whether the Image Time feature has been enabled. Image Time can be enabled by setting EIT (Bit 1 of Word 0 of BTW3) before the configuration block transfer (BTW3) is executed.

INPUT IMAGE (Image Time Disabled)

Word	17	16	15	14	13	12	11	10	7	6	5	4	3	2	1	0
I:ggg	TNS	Rsv	Rsv	LOC	ANT	RBT	OVL	PPS	Rsv	Rsv	Rsv	Rsv	Rsv	Rsv	Rsv	Rsv
I:ggg+1	I17	I16	I15	I14	I13	I12	I11	I10	I07	I06	I05	I04	I03	I02	I01	I00

INPUT IMAGE (Image Time Enabled)

Word	17	16	15	14	13	12	11	10	7	6	5	4	3	2	1	0
I:ggg	TNS	Rsv	Rsv	LOC	ANT	RBT	OVL	PPS	Rsv	Rsv	Rsv	Rsv	Rsv	Rsv	Rsv	Rsv
I:ggg+1	Second						Millisecond									

Figure 5.1 : Connected Input Image

TNS	**Time Not Synchronized** 0 = Time Synchronized to GPS 1 = Time NOT Synchronized The module does not have GPS time and thus is unable to accurately time-stamp events. Note that events will continue to be logged to the buffer, but with possible erroneous time-stamps.
Rsv	Reserved for Future Use
LOC	**Satellite Lock** 0 = Not tracking sufficient satellites to provide positional / chronological fixes. 1 = Sufficient satellites being tracked to provide positional fix Typically, tracking 4 satellites is sufficient to provide lock.
ANT	**Antenna OK** 0 = Antenna Fault 1 = Antenna OK An Antenna fault will occur if the antenna is not present or has been damaged.

INPUT IMAGE (CONTINUED)

RBT	**Ready for Event Block Transfer Read** 0 = No Events in buffer 1 = One or more events in buffer, which are ready for transfer via Block Transfer. Note that if an Event Block Transfer Read is attempted when the buffer is empty, the PLC BTR instruction will fail with Time-out error (-9).
OVL	**Buffer Overflow Latch** 0 = Buffer has not overflowed. 1 = Buffer has Overflowed. This Latch will be set when more than 1000 events have been logged to the buffer but not yet transfered by a Block Transfer. Once the buffer as Overflowed this bit will remain set until an Overflow Latch Clear command has been issued.
PPS	**Pulse per Second** This bit transitions from 0 to 1 precisely every second. The pulse duty cycle is approximately 50%.
BT Rsv	Reserved for Block Transfer
I17	Digital Input 17 : Post Digital Filtering
I16	Digital Input 16 : Post Digital Filtering
I15	Digital Input 15 : Post Digital Filtering
I14	Digital Input 14 : Post Digital Filtering
I13	Digital Input 13 : Post Digital Filtering
I12	Digital Input 12 : Post Digital Filtering
I11	Digital Input 11 : Post Digital Filtering
I10	Digital Input 10 : Post Digital Filtering
I07	Digital Input 07 : Post Digital Filtering
I06	Digital Input 06 : Post Digital Filtering
I05	Digital Input 05 : Post Digital Filtering
I04	Digital Input 04 : Post Digital Filtering
I03	Digital Input 03 : Post Digital Filtering
I02	Digital Input 02 : Post Digital Filtering
I01	Digital Input 01 : Post Digital Filtering
I00	Digital Input 00 : Post Digital Filtering
Second	Real-time Seconds. (0-59)
Millisecond	Real-time milliseconds. (0-999)

5.2 OUTPUT IMAGE

OUTPUT IMAGE																
Word	17	16	15	14	13	12	11	10	7	6	5	4	3	2	1	0
O:ggg	OLC	Rsv	Rsv	Rsv	Rsv	Rsv	Rsv	Rsv	Rsv	Rsv	Rsv	Rsv	Rsv	Rsv	Rsv	Rsv
O:ggg+1	M17	M16	M15	M14	M13	M12	M11	M10	M07	M06	M05	M04	M03	M02	M01	M00

OLC	**Buffer Overflow Latch Clear Command** 0 = No effect. 1 = Clear Buffer Overflow Latch The latch will continuously be cleared if the OLC bit remains set. It is thus recommended that this bit be set and immediatlel cleared. Once the buffer as Overflowed this bit will remain set until an Overflow Latch Clear command has been issued.
Rsv	Reserved for Future Use
BT Rsv	Reserved for Block Transfer
M17	Memory Event Output 17
M16	Memory Event Output 16
M15	Memory Event Output 15
M14	Memory Event Output 14
M13	Memory Event Output 13
M12	Memory Event Output 12
M11	Memory Event Output 11
M10	Memory Event Output 10
M07	Memory Event Output 07
M06	Memory Event Output 06
M05	Memory Event Output 05
M04	Memory Event Output 04
M03	Memory Event Output 03
M02	Memory Event Output 02
M01	Memory Event Output 01
M00	Memory Event Output 00

CHAPTER 6 BLOCK TRANSFERS

The 1771HP-GPS module requires the use of Block Transfers to transfer specific data to and from the PLC CPU.

The type of data packet received or sent during a block transfer is dependant on the Length of the respective Block Transfer Read (BTR) or Block Transfer Write (BTW).

Only specific BTR and BTW Lengths are permissible, the rest will be ignored by the module, resulting in a time-out error being reported by the respective PLC transfer instruction.

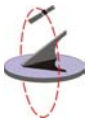
BTR 5 : READ EVENT FROM BUFFER

This instruction is used to read an event from the 1771HP-GPS event buffer. Note that instruction should only be executed if data is available, i.e. when the RBT (I:ggg/12) bit is set.

BTR Length 5 : READ EVENT FROM BUFFER

Word	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	ETS	MX			EvtMonth							EvtDay				
1				EvtHour							EvtMinute					
2	EvtSecond						EvtMillisecond									
3	E17	E16	E15	E14	E13	E12	E11	E10	E07	E06	E05	E04	E03	E02	E01	E00
4	C17	C16	C15	C14	C13	C12	C11	C10	C07	C06	C05	C04	C03	C02	C01	C00

ETS	**Event Time Not Synchronized** 0 = Event Time Synchronized to GPS 1 = Event Time NOT Synchronized The GPS Time synchronization status (TNS) at the time the event was logged. If this bit is set then the event time-stamp data should be regarded as suspect.
MX	**Memory / External Input Event Trigger** 0 = Event triggered by External Input Change 1 = Event triggered by Memory Change
EvtMonth	The Month when the respective Event was triggered. (1-12)
EvtDay	The Day when the respective Event was triggered. (1-31)
EvtHour	The Hour when the respective Event was triggered. (0-23)
EvtMinute	The Minute when the respective Event was triggered. (0-59)



EvtSecond	The Second when the respective Event was triggered. (0-59)
EvtMillisecond	The Millisecond when the respective Event was triggered. (0-999)
E17	Memory / External Input 17, when Event was triggered
E16	Memory / External Input 16, when Event was triggered
E15	Memory / External Input 15, when Event was triggered
E14	Memory / External Input 14, when Event was triggered
E13	Memory / External Input 13, when Event was triggered
E12	Memory / External Input 12, when Event was triggered
E11	Memory / External Input 11, when Event was triggered
E10	Memory / External Input 10, when Event was triggered
E07	Memory / External Input 07, when Event was triggered
E06	Memory / External Input 06, when Event was triggered
E05	Memory / External Input 05, when Event was triggered
E04	Memory / External Input 04, when Event was triggered
E03	Memory / External Input 03, when Event was triggered
E02	Memory / External Input 02, when Event was triggered
E01	Memory / External Input 01, when Event was triggered
E00	Memory / External Input 00, when Event was triggered
C17	Set if Memory / External Input 17, changed
C16	Set if Memory / External Input 16, changed
C15	Set if Memory / External Input 15, changed
C14	Set if Memory / External Input 14, changed
C13	Set if Memory / External Input 13, changed
C12	Set if Memory / External Input 12, changed
C11	Set if Memory / External Input 11, changed
C10	Set if Memory / External Input 10, changed
C07	Set if Memory / External Input 07, changed
C06	Set if Memory / External Input 06, changed
C05	Set if Memory / External Input 05, changed
C04	Set if Memory / External Input 04, changed
C03	Set if Memory / External Input 03, changed
C02	Set if Memory / External Input 02, changed
C01	Set if Memory / External Input 01, changed
C00	Set if Memory / External Input 00, changed

BTR 7 : READ DATE, TIME & STATUS

This instruction is used to read the current Date, Time and status of the 1771HP-GPS Module.

BTR Length 7 : READ DATE, TIME & STATUS																
Word	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	CurYear							CurMonth				CurDay				
1				CurHour							CurMinute					
2											CurSecond					
3	BufferLength															
4	InputFilter															
5	TimeZone															
6	Reserved															

CurMonth	The current Month at time of Block Transfer. (1-12)
CurDay	The current Day at time of Block Transfer. (1-31)
CurHour	The current Hour at time of Block Transfer. (0-23)
CurMinute	The current Minute at time of Block Transfer. (0-59)
CurSecond	The current Second at time of Block Transfer. (0-59)
BufferLength	The number of events resident in the module buffer.
InputFilter	The current Digital Input Filter time in milliseconds.
TimeZone	The current Time-zone configuration. (-12 to 12)

BTR 9 : GPS POSITION & VELOCITY

This instruction is used to read the current GPS position and velocity. Both position and velocity results are referenced to the WGS84 Earth-Centred-Earth-Fixed co-ordinate system which is defined as follows:

- The X-axis is defined as the vector with origin at the earth's centre and passing through the intersection of the equator and the Greenwhich meridian.
- The Y-axis is defined as the vector with origin at the earth's centre and passing through the equator 90 degrees east of the Greenwhich meridian.
- The Z-axis is defined as the vector with origin at the earth's centre and passing through the North pole.

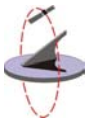
BTR Length 9 : GPS POSITION & VELOCITY																
Word	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	**ECEF X - Position (meters x 1)**															
1	**ECEF X - Position (meters / 10,000)**															
2	**ECEF Y - Position (meters x 1)**															
3	**ECEF Y - Position (meters / 10,000)**															
4	**ECEF Z - Position (meters x 1)**															
5	**ECEF Z - Position (meters / 10,000)**															
6	**ECEF X - Velocity (m/s x 10)**															
7	**ECEF Y - Velocity (m/s x 10)**															
8	**ECEF Z - Velocity (m/s x 10)**															

BTW 3 : MODULE SETUP

This instruction is used to configure the 1771HP-GPS Module.
Normally this instruction should be executed only on PLC power-up, i.e. Triggered by the PLC's First Scan bit.

BTW Length 3 : MODULE SETUP																
Word	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	Rsv	Rsv	Rsv	Rsv	Rsv	Rsv	Rsv	Rsv	Rsv	Rsv	Rsv	Rsv	Rsv	Rsv	EIT	CBF
1	**InputFilter**															
2	**TimeZone**															

CBF	**Clear Buffer** 0 = No effect. 1 = Clear ALL events from the Buffer. The buffer will be cleared each time the BTW is triggered if the CBF bit is set.
EIT	**Enable Image Time** 0= Display Input Status on input image 1= Display Seconds and Milliseconds on input image
InputFilter	Configures the Digital Input Filter time in milliseconds.
TimeZone	Configures the Time-zone configuration. (-12 to 12)

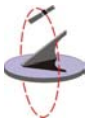


CHAPTER 7 MODULE STATUS

The current status of the module may be ascertained by either reading the status words via the PLC5 backplane or by monitoring the alpha-numeric Status Display.

STATUS DISPLAY

TmOk	**Time Synchronization Ok** The module has successfully time synchronised with the GPS satellite system and has accurate time.
Tm??	**Time Synchronization Failure** The module has lost time synchronisation with the GPS satellite system and cannot maintain accurate time.
Tm?x	**Time Synchronization Failure** The module has lost time synchronisation with the GPS satellite system and cannot maintain accurate time. Where x denotes a time error code (0-9)
IEvt	**External Input Event Triggered** A change in the status of one or more of the External Inputs has generated an event.
MEvt	**Memory Event Triggered** A change in the status of one or more of the Memory Output Image bits has generated an event.
Empt	**Event Buffer Empty** There are zero events in the Event Buffer.
Full	**Event Buffer Full** There are 1000 events in the Event Buffer, rendering it unavailable for event logging.
OvFl	**Event Buffer Overflow** An event was generated but could not be logged as the Event Buffer was already full.
Clr	**Event Buffer Overflow Latch Cleared** The Event Buffer Overflow Latch has been cleared by the PLC. This is achieved by momentarily setting the OLC bit
Purg	**Event Buffer Purged** All events in the Event Buffer have been deleted. This is achieved by setting the CBF bit followed by a BTW3.
EPro	**Event Processor Started** The Event Processor has started and is ready to process memory events. This typically occurs 3 seconds after power or changing to Run mode. Note that External Input Events are immediately available on Power-up of the module, and remain active when the PLC CPU enters program mode.



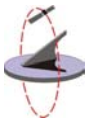
Prog	**PLC entering PROGRAM mode** The PLC CPU is entering program mode or is powering-down.
Run	**PLC entering RUN mode** The PLC CPU is entering run mode or is powering-up.
RmEr	**Internal Memory Failure** RAM check has failed. Check PLC power supply. Contact supplier.
BTR5	**Successful BTR5 request** The module has successfully processed a Block Transfer Read (Length 5) Request from the PLC CPU. The data returned will contain the next event from the Event Buffer.
BTR7	**Successful BTR7 request** The module has successfully processed a Block Transfer Read (Length 7) Request from the PLC CPU. The data returned will contain Date, Time and module Status information.
BTW3	**Successful BTW3 transaction** The module has successfully processed data sent from the PLC CPU via a Block Transfer Write (Length 3) . Although this indicated that configuration data has been sent to the 1771HP-GPS module by the PLC it is recommended that the configuration be read back by means of a BTR7 to confirm.
AntO	**GPS Antenna Open-circuit** Indicates the Antenna is not connected or damaged.
AntX	**GPS Antenna Short-circuit** Indicates the Antenna patch-lead is shorted or damaged or the Antenna is damaged.
Sky	**No Sky Available** Indicates the absence of any satellite signals. This usually occurs when the Antenna is placed indoors, or during power-up before Lock is achieved.
Srch	**Satellite Search** Module is attempting to acquire satellites
Cold	**Cold Initialisation Required** Indicates that the module is devoid of internal satellite information.
Time	**Satellite Time Synchronisation in Progress** Indicates that the module is receiving satellite signals but has not yet been able to synchronise to GPS time.
Lock	**Satellite Lock** Indicates that sufficient satellites are being tracked to provide position fixing.
PDOP	**Position Dilution of Precision Warning** Position Dilution of Precision occurs when although there are sufficient satellites in lock, 2 or more of them appear to occupy similar positions in the sky and thus the number of effective satellites is decreased.

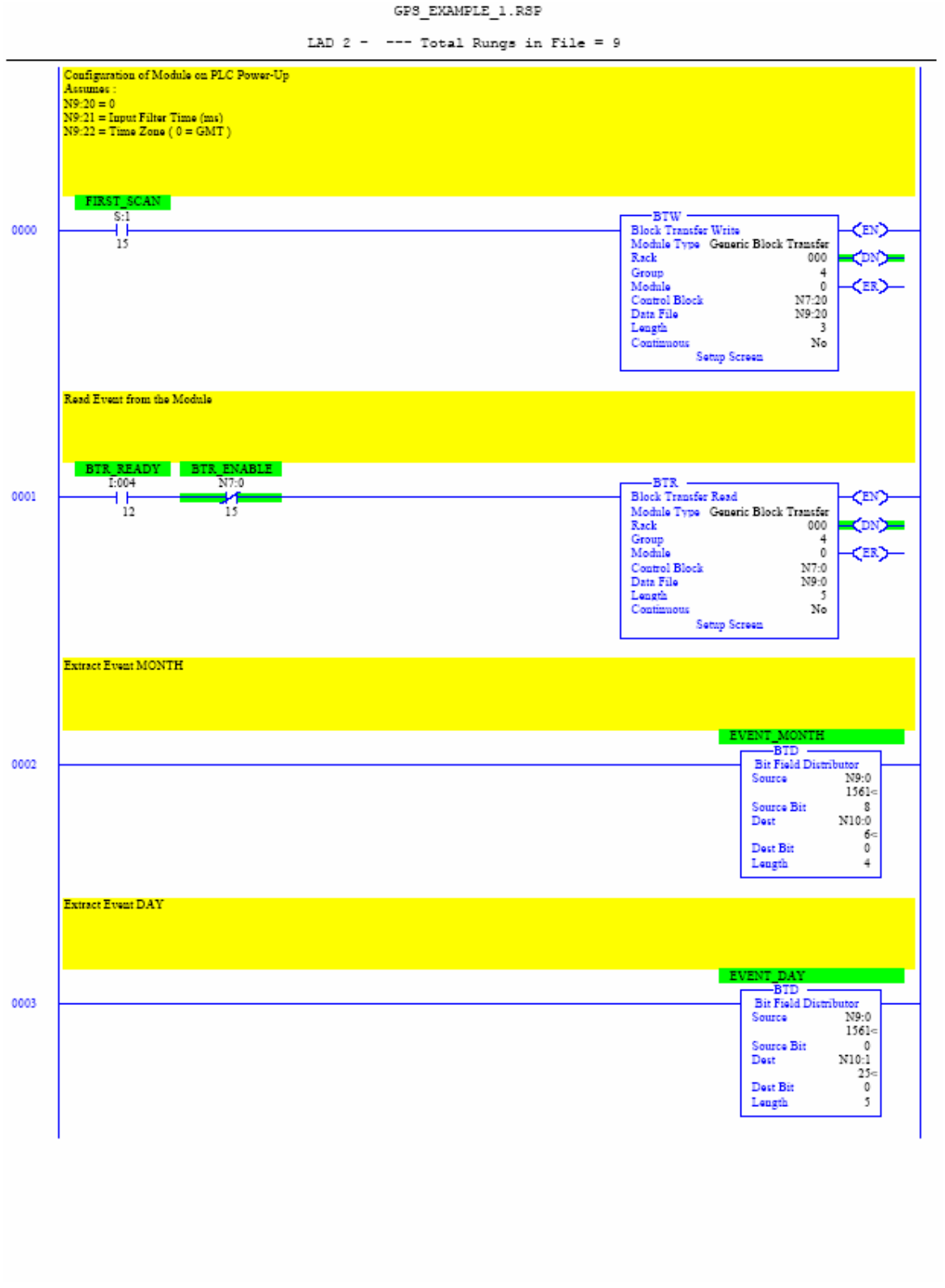
Trk1	**Tracking only 1 Satellite**
Trk2	**Tracking only 2 Satellites**
Trk3	**Tracking only 3 Satellites**
SBad	**Current Satellite is Bad** The satellite signal currently being acquired is suspect or unusable.

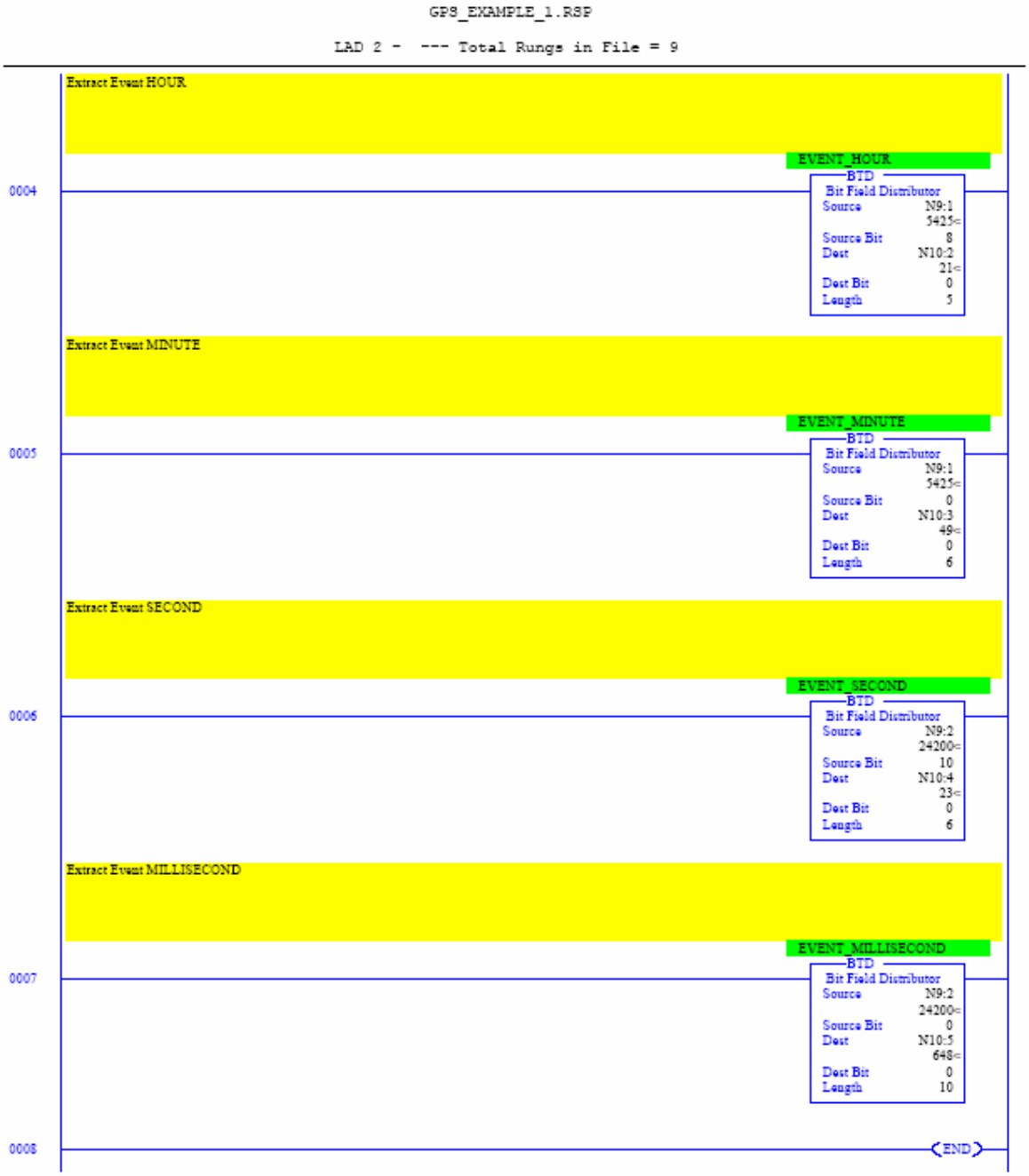
APPENDIX A PLC LADDER EXAMPLE

A.1 LADDER EXAMPLE 1

- The module is configured on power-up
- As an event is logged by the module it is read
- The event Date/Time data is extracted




GPS_EXAMPLE_1.RSP
LAD 2 - --- Total Rungs in File = 9
Configuration of Module on PLC Power-Up
Assumes :
N9:20 = 0
N9:21 = Input Filter Time (ms)
N9:22 = Time Zone (0 = GMT)
FIRST_SCAN
S:1
15
0000
BTW
Block Transfer Write
Module Type Generic Block Transfer
Rack 000
Group 4
Module 0
Control Block N7:20
Data File N9:20
Length 3
Continuous No
Setup Screen
EN
DN
ER
Read Event from the Module
BTR_READY
I:004
12
BTR_ENABLE
N7:0
15
0001
BTR
Block Transfer Read
Module Type Generic Block Transfer
Rack 000
Group 4
Module 0
Control Block N7:0
Data File N9:0
Length 5
Continuous No
Setup Screen
EN
DN
ER
Extract Event MONTH
EVENT_MONTH
0002
BTD
Bit Field Distributor
Source N9:0
1561<
Source Bit 8
Dest N10:0
6<
Dest Bit 0
Length 4
Extract Event DAY
EVENT_DAY
0003
BTD
Bit Field Distributor
Source N9:0
1561<
Source Bit 0
Dest N10:1
25<
Dest Bit 0
Length 5

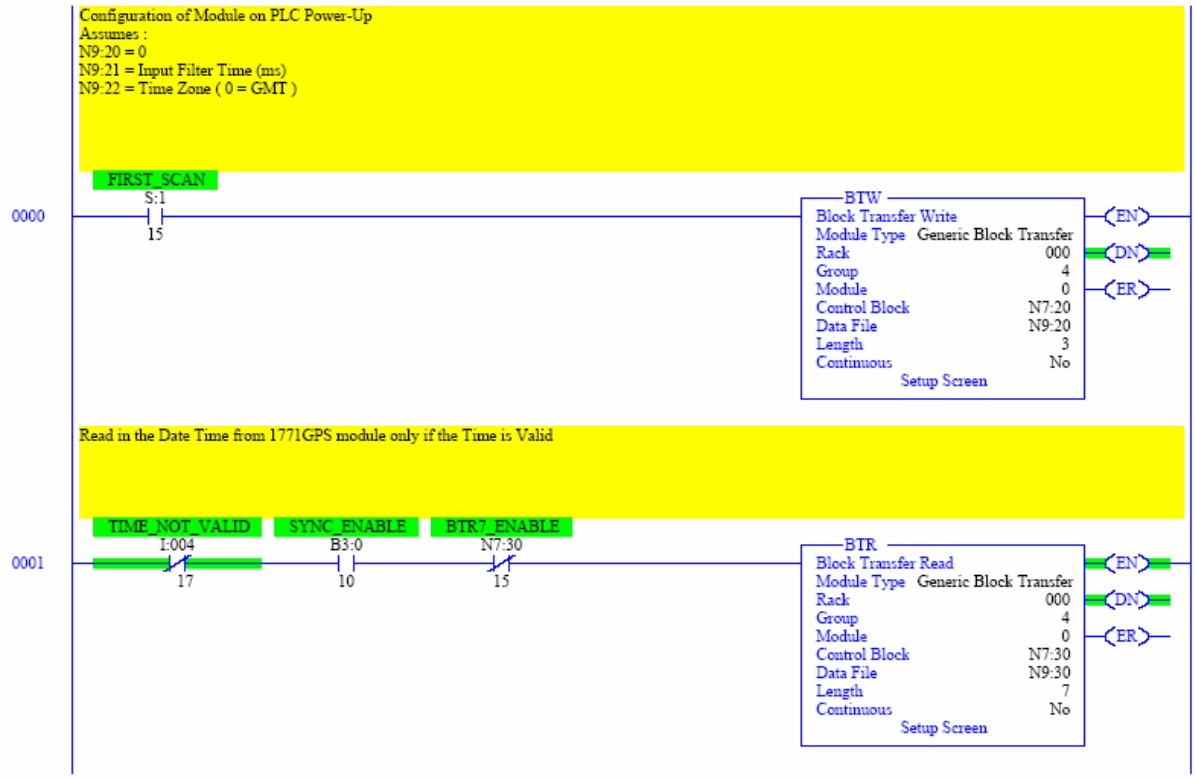

GPS_EXAMPLE_1.RSP
LAD 2 - --- Total Rungs in File = 9
Extract Event HOUR
EVENT_HOUR
0004
BTD
Bit Field Distributor
Source N9:1
5425
Source Bit 8
Dest N10:2
21
Dest Bit 0
Length 5
Extract Event MINUTE
EVENT_MINUTE
0005
BTD
Bit Field Distributor
Source N9:1
5425
Source Bit 0
Dest N10:3
49
Dest Bit 0
Length 6
Extract Event SECOND
EVENT_SECOND
0006
BTD
Bit Field Distributor
Source N9:2
24200
Source Bit 10
Dest N10:4
23
Dest Bit 0
Length 6
Extract Event MILLISECOND
EVENT_MILLISECOND
0007
BTD
Bit Field Distributor
Source N9:2
24200
Source Bit 0
Dest N10:5
648
Dest Bit 0
Length 10
0008
END

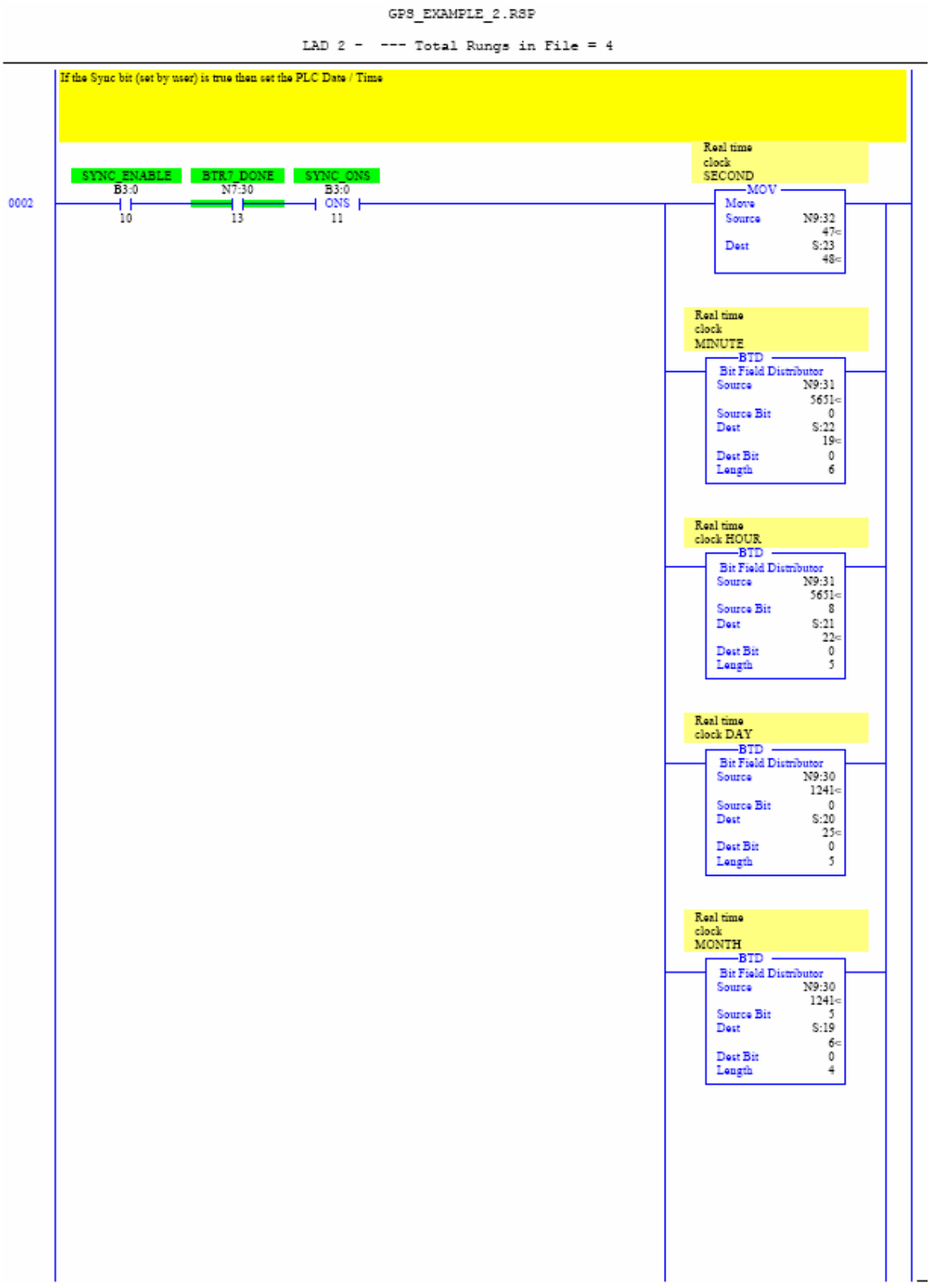
A.2 LADDER EXAMPLE 2

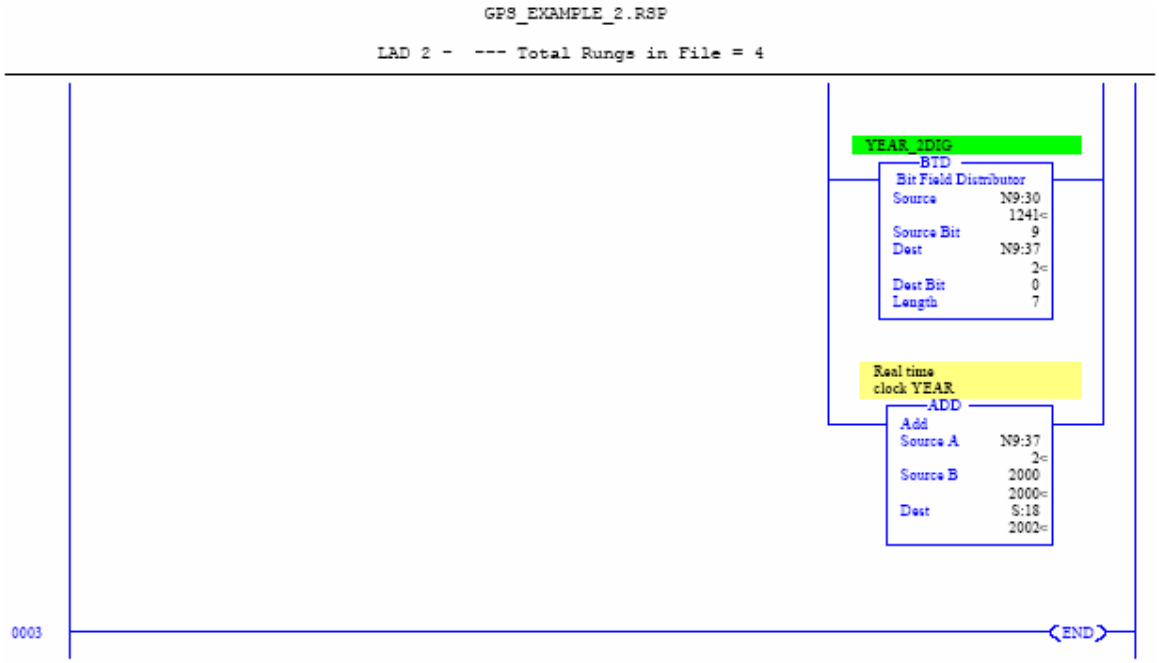
- The module is configured on power-up
- Real-Time data is read from the module
- The PLC's Date/Time registers are synchronized to the module.

GPS_EXAMPLE_2.RSP

LAD 2 - --- Total Rungs in File = 4




GPS_EXAMPLE_2.RSP
LAD 2 - --- Total Rungs in File = 4
If the Sync bit (set by user) is true then set the PLC Date / Time
SYNC_ENABLE
B3:0
10
BTR7_DONE
N7:30
13
SYNC_ONS
B3:0
ONS
11
0002
Real time clock SECOND
MOV
Move
Source N9:32 47
Dest S:23 48
Real time clock MINUTE
BTD
Bit Field Distributor
Source N9:31 5651
Source Bit 0
Dest S:22 19
Dest Bit 0
Length 6
Real time clock HOUR
BTD
Bit Field Distributor
Source N9:31 5651
Source Bit 8
Dest S:21 22
Dest Bit 0
Length 5
Real time clock DAY
BTD
Bit Field Distributor
Source N9:30 1241
Source Bit 0
Dest S:20 25
Dest Bit 0
Length 5
Real time clock MONTH
BTD
Bit Field Distributor
Source N9:30 1241
Source Bit 5
Dest S:19 6
Dest Bit 0
Length 4


GPS_EXAMPLE_2.RSP
LAD 2 - --- Total Rungs in File = 4
YEAR_2DIG
BTD
Bit Field Distributor
Source N9:30
1241
Source Bit 9
Dest N9:37
2
Dest Bit 0
Length 7
Real time
clock YEAR
ADD
Add
Source A N9:37
2
Source B 2000
2000
Dest S:18
2002
0003
END

APPENDIX B SPECIFICATIONS

Parameter	Specification
General	
Module Location	Any Slot
Electrical	
Backplane Current	515mA @ 5.1V
	3mA @ 24V
Schedules Connection Paramters	
RPI	0.2ms to 750ms
GPS Receiver Specification	
General	L1 frequency (1575.42 MHz), C/A code (Standard
	Positioning Service), 8-channel, continuous tracking receiver,
	32 correlators
Accuracy Horizontal	<6 meters (50%), <9 meters (90%)
Altitude	<11 meters (50%), <18 meters (90%)
Velocity	0.06 m/sec
Time	±95 ns or 1 RPI
Hot Start	<14 sec. (50%), <18 sec. (90%)
Warm Start	<38 sec. (50%), <45 sec. (90%)
Cold Start	<90 sec. (50%), <170 sec. (90%)
Antenna	
Antenna Connector	SMA female connector
Frequency Range	1575.42 MHz ± 1.023 MHz
Polarization	Right-hand circular polarization (RHCP)
Output Impedance	50Ω
VSWR	2.0 maximum
Axial Ratio	90°: 4.0 dB maximum; 10°: 6 dB maximum
Gain	35 dB ± 3 Db
Out of Band Rejection	fo: 1575.42 MHz
	fo ± 20 MHz : 7dB min
	fo ± 30 MHz : 12dB min
	fo ± 40 MHz : 20dB min
	fo ± 100 MHz : 100dB min
Azimuth Coverage	360° (omni-directional)
Elevation Coverage	0° to 90° elevation (hemispherical)
Antenna Patch Lead	
Coax Type	RG-58
Impedance	50Ω

APPENDIX C GLOSSARY

Communications format
Format that defines the type of information transferred between an I/O module and its owner controller. This format also defines the tags created for each /O module

Coordinated System Time (CST)
Timer value which is kept synchronized for all modules within a single ControlBus chassis. The CST is a 64 bit number with μs resolution.
Coordinated System Time (CST)

Download
The process of transferring the contents of a project on the workstation into the controller

Earth-Centered-Earth-Fixed (ECEF) coordinates
Cartesian coordinate system where the X direction is the intersection of the prime meridian (Greenwich) with the equator. The vectors rotate with the earth. Z is the direction of the spin axis, with positive through the north pole.

GPS (Global Positioning System)
A constellation of 24 radio navigation (not communication) satellites which transmit signals used (by GPS receivers) to determine precise location (position, velocity, and time) solutions. GPS signals are available world-wide, 24 hours a day, in all weather conditions. This system also includes 5 monitor ground stations, 1 master control ground station, and 3 upload ground stations.

GPS Antenna
An antenna designed to receive GPS radio navigation signals. These antennas typically comprise a Low Noise Amplifier (LNA) and are known as active, and thus require DC power.

GPS Processor
An electronic device that interprets the GPS radio navigation signals (received by a GPS antenna) and determines a location solution.

GPS Receiver
The combination of a GPS antenna and a GPS processor.

Owner controller
The controller that creates and stores the primary configuration and communication connection to a module

PDOP Position Dilution of Precision.
PDOP is a unitless figure of merit that describes how an uncertainty in pseudo-range affects position solutions.

PRN Pseudo-random noise.

Each GPS satellite generates its own distinctive PRN code, which is modulated onto each carrier. The PRN code serves as identification of the satellite, as a timing signal, and as a subcarrier for the navigation data.

Producer/consumer
Intelligent data exchange system devices in which the GPS module produces data without having been polled first.

Removal and insertion under power (RIUP)
ControlLogix feature that allows a user to install or remove a module or RTB while power is applied.

Requested packet interval (RPI)
A configurable parameter which defines when the module will multicast data

Service
A system feature that is performed on user demand

Signal to noise ratio
A measure of the relative power levels of a communication signal and noise on a data line. SNR is expressed in decibels (dB).

SV
Space Vehicle (GPS satellite).

Tag
A named area of the controller's memory where data is stored like a variable

(……../// end of document)