

# **COMMENTARY ON INTELLIGENT HANDSET SERIAL PROTOCOL Iss 3**

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## **1. SERIAL SETUP & TIMING**

The serial port operates at 9600,N,8,1 with hardware handshakes (RTS/CTS). The handset indicates 'HOST CONNECTED' when a connection is made with RTS from PC and 'HOST DISCONNECTED' at break in cable.

The 6 pin RJ12 cable pinout is **NOT** the same as the LX200 telescope. A special lead is required from AWR to connect to external serial devices.

Commands are buffered in the IH (up to 256 characters) and are processed as high priority events with a small latency of up to 10ms after the full command has been received.

All commands received must start with a **:** and end with a **#**

Protocol mode can be changed in FACTORY – COMMS to either **DEBUG, LX200** emulation or **AWR**.

- **DEBUG** mode includes all transactions to and from the Drivebox as well as complete AWR mode. Selected other processes (like GOTO) have extra debug available.
- **LX200** emulation implements the low resolution data as used in this industry standard protocol.
- **AWR** mode includes full precision data, extra commands and events coming out at any time to the PC. Most planetarium programmes can make use of the extra precision. The extra event information is ignored by the planetarium programmes. All replies to the host have '**#**' delimiting except the <ACK> and <NACK>.

The handset is capable of turning around at least seven commands per second depending on how much processing is involved.

## **2. NOMENCLATURE**

All serial characters are denoted by **HEAVY TYPE**

Single engineering characters are denoted by **<ACK>**

Carriage returns or line feeds are not essential.

**s** = SIGN + or - number

**String** is a message

### 3. GET DATA FROM IH

COMMAND	FUNCTION	SHORT	LONG
:GR#	Get RA	HH:MM.M#	HH:MM:SS#
:GD#	Get Dec	sDD°MM#	sDD°MM:SS#
:GA#	Get Altitude	sDD°MM#	sDD°MM:SS#
:GZ#	Get Azimuth	DDD°MM#	DDD°MM:SS#
:GS#	Get Local Sidereal Time	HH:MM:SS#	HH:MM:SS#
:GH#	Get Hour Angle	sHH:MM:SS#	sHH:MM:SS#
:GL#	Get Local time	HH:MM:SS#	HH:MM:SS#
:GC#	Get Calendar Date	MM/DD/YY#	MM/DD/YY#
:Gt#	Get Latitude	sDD°MM#	sDD°MM#
:Gg#	Get Longitude	DDD°MM#	DDD°MM#
:GG#	Get GMT Offset	sHH#	sHH#

### 4. SET DATA IN IH

COMMAND	FUNCTION	REPLY
:SrHH:MM:SS# or :SrHH:MM.M#	Set RA coordinate (long or short format)	1 = ok 0 = not ok
:SdsDD°MM:SS# or :SdsDD°MM#	Set DEC coordinate (long or short format)	1 = ok 0 = not ok
:SLHH:MM:SS#	Set Local Time	1 = ok 0 = not ok
:SC#	Set Calendar Date	String# 0 = not ok
:St#	Set Latitude	1 = ok 0 = not ok
:Sg#	Set Longitude	1 = ok 0 = not ok
:SGsHH#	Set GMT Offset	1 = ok 0 = not ok

### 5. CONTROL COMMANDS

COMMAND	FUNCTION	REPLY
:RG#	Select GUIDE rate	None
:RC#	Select CENTRE rate	None
:RM#	Select MOVE rate	None
:RS#	Select SLEW rate	None
:Mn#	Move North	None
:Ms#	Move South	None
:Me#	Move East	None
:Mw#	Move West	None
:Qn#	Stop North	None
:Qs#	Stop South	None
:Qe#	Stop East	None

:Qw#	Stop West	None
:MS#	Start GOTO	0 = ok 1(string)# = scope moving 2# = data invalid
:Q#	Abort GOTO	None
:CM#	Sync	OK# = synchronized else (string)#
:Fxy#	Operate Relay x (1, 2, 3) with y 0 (off) or 1 (on)	None
:X?#	Query movement status during GOTO	U0# = tracking Un# = Goto in progress
:DB#	Enter DATABASE ENTRY MODE for file transfer	None
<ACK>	Get Mounting Type	P = Fork G = GEM
:GVN#	Get IH firmware version	v1.726#
:GSP#	Get side of pier	a# - = not calibrated C = FORK type calibrated E = GEM type in East W = GEM type in West
:^xxx#	Pipeline cmd xxx to Drivebox	See Microstep Protocol
:PEx#	Periodic error playback ena	None
:EXy#	Tracking control issue y=0 to stop and y=1 to start	None
OTHER	Command not present	<NACK>

## 6. SPECIAL SEQUENCES and NOTES

- To **synchronise** the coordinate frame with an object (does CAL1) send 'Sr' 'Sd' 'CM'.
- To perform a **GOTO** send 'Sr' 'Sd' 'MS'. The GOTO status comes out as events with :Xab# (see below).
- 'Rx' sets adjust speed to Guide or Centre or Move or Slew which is then performed when you command a move 'Mx'.
- 'Fnx' remotely presses USER BUTTONS (n=1,2,3) with x=0 for OFF and x=1 for ON. If the drivebox has relays then these will be activated.
- 'X?' queries the movement status during GOTO. When it returns to 0 the GOTO has finished. Poll the flag.
- Time setting and reading should use Universal time throughout if the **AD100** display unit is to be used. Otherwise the Local Time and the GMT Offset should be programmed. If these functions are used the IH time display should be checked.
- The command '^' is a very powerful addition allowing access to ALL the low level functions and registers in the Drivebox.
- The 'Exy' command allows parking the telescope with a normal GOTO, turning the tracking off. Then the drivebox can be powered down. The telescope will not track again until the drivebox is turned back on and

'EX1' is issued. Alternatively if the IH is powered down then it will initialize the drivebox and start tracking in the normal way.

## 7. EVENTS

Setting protocol mode to AWR, allows events from the drive box to be transmitted through the handset to the PC. These obviously can come out at any time but do not interrupt a reply in progress.

All events sent start with a **:** and end with a **#** The packet may carry data.

EVENT	FUNCTION	DATA
<b>:P#</b>	Index pulse	None
<b>:Sx#</b>	Override status	<b>0</b> = Released <b>1</b> = INHIBIT MOTION
<b>:Xab#</b>	Movement status of a = RA, b = DEC	<b>0</b> = tracking <b>n</b> = other speed
<b>:Vx#</b>	Backlash status of RA	<b>0</b> = normal <b>1</b> = reverse
<b>:Wx#</b>	Backlash status of DEC	<b>0</b> = normal <b>1</b> = reverse

## 8. EXTERNAL PROGRAMMES AND DEVICES

A special cable is required to interface with the HOST connector on the Intelligent Handset to a PC computer. It is 6 pin RJ212 but a different pinout to the LX200.

As a general rule it is not necessary to poll the Intelligent Handset more than twice per second. Data values change very slowly.

### DEVICES

**ASTRO DISPLAY UNITS (AWR AD100)** sit in the serial stream from the PC to the IH and are transparent in operation. The RS232 loops through the device. Extra commands are inserted with replies removed so that the required parameter can be displayed and not confuse the device farther down the stream. Up to 5 can be connected in series.

### PLANETARIUM SOFTWARE

**THE SKY** software will display and operate in low or full resolution mode depending on the data resolution it is given. It can be set up for LX200 GENERIC or VIXEN SS2K (any version)

**SKYMAP PRO** software only connects using LX200 protocol. It only works however in the low resolution mode.

**ASCUM INTERFACE** is used by **STARRY NIGHT PRO** and works with LX200 GENERIC or VIXEN SS2K (any version). The Intelligent Handset can be set in LX200 or AWR protocol mode. Extra resolution and drivebox events are available in AWR mode

Other Planetarium software work when set up using LX200 classic protocols.

### **AUTOGUIDERS**

**STAR2000 Starlight Xpress** interface adapter for autoguiding. This has two output ports called STANDARD and LX200. The LX200 output can connect to the IH HOST port with the correct cable. The standard port connects to a standard auto guider input port on the Drive box of the AWR intelligent Drive system.

**CCD Camera Autoguiders** (SBIG ST4, STxxxx, Starlight Xpress STV etc) interface directly to the Drivebox CCD port.

**ALL Software Autoguiders.** (Such as Guidedog, PemPro etc). It is recommended to connect these directly to the AWR Drivebox to avoid the time latency involved in going through the Intelligent Handset. You will need a parallel or serial or USB to RELAY box converter with a 6 pin RJ12 autoguider output cable. These are manufactured by Shoestring Astronomy.

For periodic error training using the autoguider (such as with PemPro) it is necessary to connect to the Intelligent Handset as the periodic error table is stored in the Handset.