

Barcode on the Dome
 The barcode are values from 0 to 1800. Each barcode is 0.2 deg apart. Physical 1.25" inches apart.

Direction	Azimuth	Barcode
North	0	342
West	270	792
South	180	1242
East	90	1692

SUMMARY of FIO_SE and Dome Drive IO.

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SB AmpEnable, TOP DomeCntl → DriveEnable (all drives)
FIOE AO VelReq → AIN0 (master only)
FIOE DO Enable/BrkRel → DIN1 (master only)
FIOE DO Reset_E100 → DIN2 (all drives)
FIOE DI "Global Err" ← DOUT (all drives)
n/c DOUT1 (Motor Brake Output)
  
```

Network Summary

Hostname	EPL_IP	Summit_IP	NodeID
t3ep1	192.168.100.254	128.171.165.137	0xFE
t3e100-0	192.168.100.240	128.171.165.138	0xF0 master
t3e100-1	192.168.100.001	128.171.165.139	0x01 slave 01
t3e100-2	192.168.100.002	128.171.165.140	0x02 slave 02

Hostname: dome-servo-pc
 Dell vostro 270
 Windows 7 64-bits

Runs Workbench software.
 Workbench communicates with E100 using USB.

E100 config file and programs are located on
 IRTF → My Documents → My Mint

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DWG #	REV	TITLE	
T3-3040	-	TCS3 Dome Control Overview Block Diagram	
ENGINEER.	LAST EDIT	SIZE	SHEET
	2/22/2013 12:38:30 PM	B	1 of 2
FILE: C:\Users\denault\Documents\dome\T3-3040-Dome_Cntl-Overview.vsd			

This description of the dome control logic was copied from the comments in the ic/fio_e/dome_cntl.c source file for tcs3. Refer to this source files for the most current information. Last updated on 2013-02-20.

The dome encoder is a serial device. The serial input stream is handle by the ic/fio_dome/dome_pos.c program. This is a 1 Hz loop that reads the barcoder serial output and store the position in shared memory.

The dome movement is controlled by the ic/fio_e/dome_cntl.c program. The dome_cntl runs at 10 Hz and handles moving the dome to the correct position using the opto22 analog and digital IO. dome_cntl also handles variable related to user input (via the GUI) and the dome handpaddles.

On Dec2012, support for newer dome servo system using the baldor e100 controller was added. The program handles control for both the old, and the new system. The control interface to the baldor e100s is similiar to the old system (DO for vel_enable(brake_release), and AO for velocity). When the compile flag, CF_E100 is 1, the baldor control is used, else the old dome_servo is used.

The CF_E100, also run the fioe_100 task that queries data from the e100 controller via ethernet to shared memory. See the code in ic/fio_e100 directory.

1. A summary of the input, output and variables related to dome control:

```
dome_cntl inputs are:
=====

// Software User inputs:
sw_mode; // UI: dome software mode [auto | manual | lock]
manual_cntl; // UI: dome manual control [forward | reverse | stop]
manual_speed; // UI: speed factor for dome manual mode [0.0 - 10.0] volts)
goto_az; // UI: destination AZ for goto mode. [0 - 2PI radians])
auto_offset; // UI: auto mode tracking offset [+/- PI radians,])

// TO Panel inputs:
to_panel.dome_cntl; // UI: Dome Control 3 position switch [ LOCKED, HANDPADDLE, SOFTWARE ]
dome.hp_left; // UI: Dome HandPaddle Reverse - off/on logic value (via montary button)
dome.hp_forward; // UI: Dome HandPaddle Forward - off/on logic value (via montary button)
dome.hp_brake; // UI: Dome HandPaddle Brake - off/on logic value (via toggle button)

// Others
dome.heater_on // DI: 1=Dome Heater is plugged in. ( DI is on fioA )
obs_azimuth // azimuth of the telescope.
obs_zenith // zenith distance of the telescope.
fioe->sb.sb_errors // flag to determine if the safety board is in an error state.
```

```
dome_cntl output are:
=====

dome.motor_cmd; // requested DA output to drive dome motors, -10 to 10v.
dome.brake_cntl; // logic for brake enable, OFF or ON
```

2. Description of Dome control:

The dome control inputs are from the TO Panel & Dome Handpaddle, and software TO Panel - dome_cntl 3-position switch (LOCKED, HANDPADDLE, SOFTWARE) Dome HandPaddle - has Left, Right, Brake_offon, and Stop buttons. Software inputs.

The dome_cntl (from the TO Panel) defines 3 principle states of the dome_control: TOP_DOME_CNTL_LOCKED - stop dome and apply brakes. TOP_DOME_CNTL_HANDPADDLE - only allow handpaddle control. TOP_DOME_CNTL_SOFTWARE - only allow software control.

Under domecnt_software, we have 4 software modes: manual mode - Control of dome D/A and brakes under user control via MCC GUI (and handpaddle Left/Right/Brake,Stop input are valid). auto mode - software is tracking the telescope's postion (ignore manual inputs). goto mode - moves the dome to a specific azimuth. lock mode - Dome is stop & brakes on.

2.1 Description of DOME_TOP_CNTL_LOCKED.

dome_da set to 0. Software inputs are ignored. (sw_mode set to locked).

2.2 Description of DOME_TOP_CNTL_HANDPADDLE.

If hp_brake is on, dome_da = 0. otherwise hp_forward or hp_left, moves the dome. Speed is limited to +/- 6 volts on the dome_da. Software inputs are ignored. (sw_mode set to locked).

2.3 Description of DOME_TOP_CNTL_SOFTWARE.

2.3.1. DOME_SW_MODE_AUTO software mode:

The target_AZ id telescope's (obs_azimuth+auto_offset). Auto mode moves the dome to match the target_AZ. Software waits until dome is > 2 deg away from target_AZ, then move the dome to obs_azimuth. Once the dome comes within 0.4 degrees, the Dome movement is stopped. if(within 2 deg of zenith), tracking not required. (don't move dome)

In auto mode, the dome_da is based on position error, where position error is (dome_position - target_AZ). If err < 2 deg, set dome_da to zero. If err between 2-5 deg, set dome_da to a magnatude of 2 volts. If err >5 deg, set dome_da to a magnatude of 5 volts.

2.3.2. DOME_SW_MODE_MANUAL software mode:

User inputs via the GUI control the manual operations: dome_manual_cntl can be RIGHT, LEFT, STOP. RIGHT - means apply positive dome_da to move the dome. LEFT - means apply negative dome_da to move the dome. STOP - means set the dome_da to 0. dome_manual_speed provide the speed in voltages.

User then set the dome_manual_speed from 0 to 10.0 (volts). User can then set dome_manual_cntl to RIGHT, LEFT, STOP.

2.3.3. DOME_SW_MODE_GOTO software mode:

User input via the GUI allow the user to input a destination AZ in deg. The software will postion the dome to this AZ.

2.3.4. DOME_SW_MODE_LOCK software mode:

dome_da set to 0. dome_brakes are Locked. dome_ampl is Disabled.

3. Brake on/off timer and ramping of dome AMP input.

When the dome_da is set to request the a dome movement, the brakes are released, then after 0.5 seconds, the voltage is applied to the opto22 Analog out module used to drive the AMP inputs.

When stopping or once the opto22 D/A output for the AMP reaches 0, a 6 seconds must elapse before the brakes are enabled. This should allow the dome to come to a stop.

The actual opto22 output to the D/A can only change at a rate of 0.70 volt/seconds. The increment of at 0.07 volts applied every 0.1 second (10 hz).

4. Dome position resolution

The position of the dome is defined by the 1800 barcode labels attached to the 360 area of the dome. This provides an encoder resolution of 360/1800 or 0.2 degrees.

5. Other signals.

When FIOA_DI_Dome_heater_sense is True, then dome_cntl forces the TOP_DOME_CNTL_LOCKED mode.

When fioe->sb.sb_errors is TRUE (Safetyboard errors exist) then dome_cntl forces the TOP_DOME_CNTL_LOCKED mode.

Where to find more Dome Documentation:

Source code


/home/tcs3/dev/ic/fio_e/dome_cntl.c – dome control code
/home/tcs3/dev/ic/fio_dome/fio_dome.c – Bar code serial input program.
/home/tcs3/dev/ic/fio_e100/fio_e100.c – queries E100 data. This directory also has some notes, and copied of the E100 configuration files.

Other web Documentation

http://irtfweb.ifa.hawaii.edu/~tcs3/tcs3/1202_dome_upgrade_docs/ - Document related to the Dome Servo Upgrade to the Baldor E100 Drives done in 2012Feb to 2013-Mar.

<http://irtfweb.ifa.hawaii.edu/~tcs3/tcs3/computers/e100/> - Note on setting up and configuring the Baldor E100 Drives.

Baldor Workbench files are on the dome-servo-pc in C:\Users\irtf\My Documents\My Mint\. After any change, they are manually sync'ed to /home/tcs3/dev/ic/fio_e100/My_Mint/ for backup. Syncback on the PC is used to sync files.

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FILE: C:\Users\denault\Documents\dome\T3-3040-Dome_Cntl-Overview.vsd			