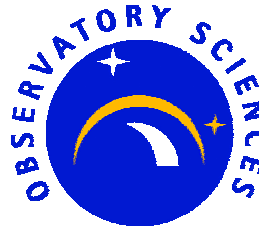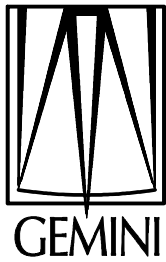# EPICS Support for a XYCOM IP Carrier and 3 IP Modules

**Andy Foster**

Observatory Sciences Ltd

Motivation

- **Gemini's Multi-Conjugate Adaptive Optics System**
  - Allows for atmospheric compensation over a 1 square arc-minute field of view
  - 36 x current capabilities with existing AO systems

- **Need to be able to control the positions of various mirrors**
  - Limit switches attached to binary inputs/outputs

- **Control of laser safety shutter**
  - aircraft avoidance, close on interrupt!!

- **Laser Power Supplies, Temperature monitoring**
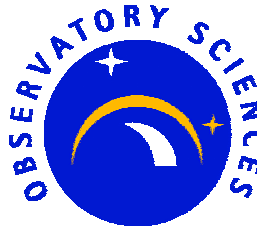 - Need 12-bit ADC card
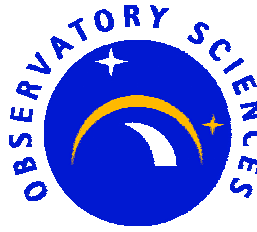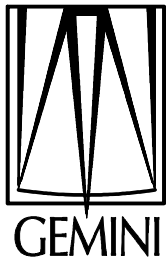
Choice of hardware

- **XYCOM IP carrier and XIP modules offered an attractive solution**
  - **All functionality in one slot, cost effective $2000**
- **XYCOM 9660 6U Carrier Board**

- **XYCOM 2440 32-Channel Isolated Digital Input Module with Interrupts**

- **XYCOM 2445 32-Channel Digital Output Module**

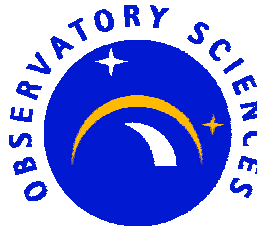- **XYCOM 5320 12-bit Analog Input Module**
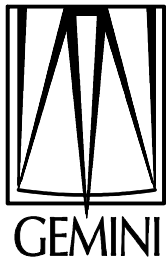
XYCOM-9660 Carrier

- **A non-intelligent carrier which provides an interface for up to 4 IP modules**

- **Provides full data and register access to the IP modules**

- **LED displays indicate successful IP access**
  - **helps debugging**

- **Supports two interrupt requests per IP**
  - **Passes interrupts from IP to VMEbus**
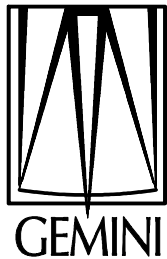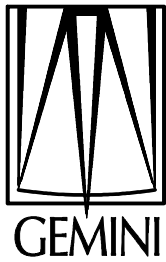
XYCOM-9660 Carrier Software

- **Implemented "drvXy9660.c" following Andrew's "drvIpac" approach**

- **Supports "initialise" function called from "ipacAddCarrier" in the startup script**

- **Supports "baseAddr" – returns base address for requested slot and address space**

- **Supports "irqCmd" to handle interrupt control**

- **Supports "report" to get status of slot**
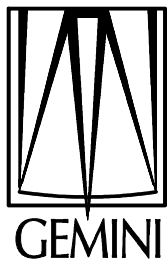
XYCOM-2440 Digital Input

- **Monitoring of 32 optically-isolated inputs**
- **High Speed/0 Wait states – all read cycles complete in 250ns**
- **Three models provide interface capability from ±4 to ±60 V**
- **Interrupts are software programmable for low-to-high or high-to-low transitions**
- **Programmable debounce time for each port**
- **No jumpers to set!**

XYCOM-2440 Digital Input Software
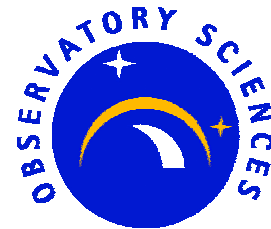
- **Implemented "drvXy2440.c" and "devXy2440.c"**
- **For each 2440 module, call:**

xy2440Create <card name> <carrier board no> <slot no> <mode> <interrupt type> <user function> <interrupt no> <event register> <debounce register>

- **mode**
  - STANDARD or ENHANCED. Interrupts and debounce control are only available in ENHANCED mode
- **interrupt type**
  - COS (Change of State). Needs bi-wiring of input channels.
  - LEVEL (Pre-determined transition)
- **user function**
  - if defined, will be called from the ISR routine, so in ISR context. Passed the port and bit number.
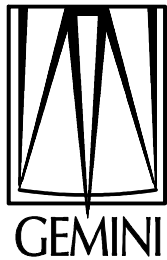
XYCOM-2440 Digital Input Software contd.
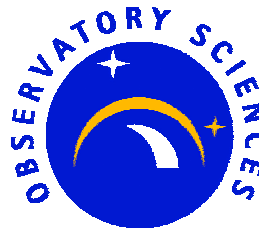
- **event register**
  - A byte that defines which transition will cause an interrupt. Each bit corresponds to 4 input channels

- **debounce register**
  - A byte which defines the duration of debounce for each port (8 input channels). Choices range from 3-4 μsec to 6-8 msec

- **EPICS Device Support written for "bi", "mbbi" and "mbbiDirect" records.**

- **The driver can be used without EPICS by compiling with "-D NO_EPICS"**
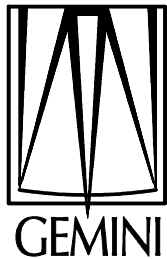
Differences from the current Xycom-240 Support

- **True interrupts are supported.**
  - **The current xycom-240 driver polls at 30 Hz and simulates interrupts for "I/O Intr" scanned records.**

- **An IOSCANPVT pointer is defined for each bit on the card. Thus, only those records connected to the interrupting bit, will process. True for "bi", "mbbi" and "mbbiDirect".**
  - **In contrast, the current xycom-240 driver defines 1 IOSCANPVT per card, thus all records get processed whether they are interested in the bit or not.**
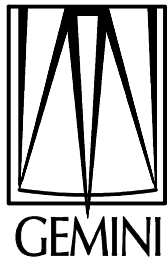
XYCOM-2445 Digital Output

- **Control of 32 optically-isolated outputs**

- **High Speed/0 Wait states – all write cycles complete in 250ns**

- **Loop back compatible with the xycom-2440.**

- **No jumpers to set. All configuration through software.**
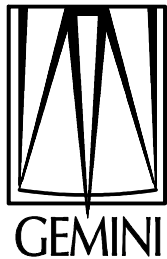
XYCOM-2445 Digital Output Software

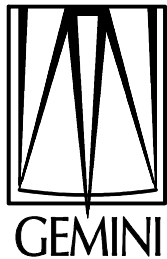- **Implemented "drvXy2445.c" and "devXy2445.c"**

- **For each 2445 module, call:**

  xy2445Create <card name> <carrier board no> <slot no>

- **EPICS Device Support written for "bo", "mbbo" and "mbboDirect" records.**

- **The driver can be used without EPICS by compiling with "-D NO_EPICS"**

- **Very simple – not much to it!**
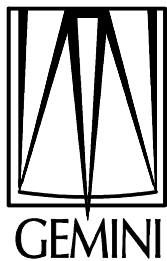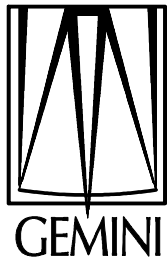
XYCOM-5320 Analog Input

- **Monitor up to 20 differential or 40 single-ended channels.**

- **12-bit accuracy**
  - **Contains an enhanced, 12-bit, successive approximation ADC with an 8.5μs conversion time**

- **High Speed**
  - **100K samples per second can be obtained using the pipelined mode of operation**

- **Hardware jumpers allow for 3 voltage ranges:**

  –5 to +5V, -10 to +10V and 0 to +10V

  and also either external or internal power supply

- **Programmable gains of 1, 2, 4 and 8 for each channel**

- **Software/Hardware Trigger for acquisition**

- **On-board voltage calibration sources**
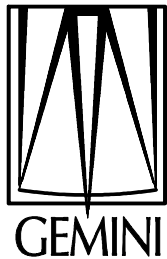
XYCOM-5320 Analog Input Software

- **Implemented "drvXy5320.c" and "devXy5320.c"**

- **Calibration is achieved by a vxWorks task which activates every 30 minutes**

- **For each 5320 module, call:**

  xy5320Create <card name> <carrier board no> <slot no> <voltage range> <input type> <no samples to average> <name of file containing channels and gains>

- **voltage range**
  - **can be "-5TO5", "-10TO10" or "0TO10"**
  - **Remember jumpers need changing as well!**

- **input type**
  - **can be "DIF" or "SE"**

XYCOM-5320 Analog Input Software contd.
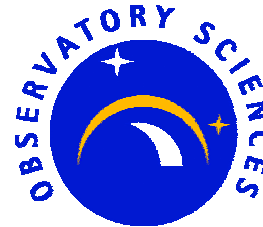
- **File containing channels and gains is very important!**
  - Controls which channels will be acquired during this session.

- **Can repeat channels with different gain settings if desired. Very flexible.**

- **EPICS Device Support written for "ai" and "waveform" records.**

- **For the "waveform" record, NELM must be set to twice the number you first thought of plus 1!**
  - Why? I wanted to return the channel number and channel value within the array and the number of channels read.
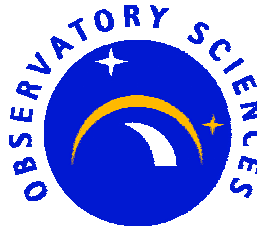
XYCOM-5320 Analog Input Software contd.

- **Can connect the output of the "waveform" to a "genSub" record to print the values if desired.**

- **Can obtain both analog and digital values (from separate "waveform" records) by specifying FTVL to be DOUBLE or LONG.**
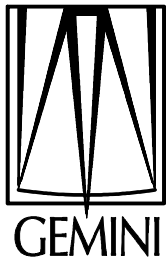
Status

- **Written, tested and debugged (on PPC and 68k)**

- **Documentation in progress**

- **Carrier Board Driver to go to Andrew for inclusion in the "drvIpac" package**

- **The rest of it will be found at:**

  http://ftp.gemini.edu/staff/afoster

  in the near future. (N.B. The "genSub" record is also at this location).