Dept. of Astronomy - MS1221,
San Diego State University,
San Diego,
California - 92182.
United States of America.

26 June 1997.

Dear Dr. Leach,

The Isaac Newton Group of telescopes, situated on La Palma island in the Canary group, have evaluated the "San Diego State University" (SDSU) CCD controller as well as others as a replacement and new technology standard for our observatory. We are pleased to inform you that the SDSU system has been selected as one that we wish to evaluate further and to this end we ask that you would provide us with a written quote for our purchase of the following list of system items. We have relied on your web published document - "Optical and Infrared Camera Electronics User's Manual" as the base specification for these systems and will expect that the deliverables will comply to this document. In addition we have stated in the list below specifications that may not be available in the standard controller. We ask that, if possible, you state prices and conditions in addition and as separate items to the standard model that would comply with these specifications. We require a guarantee of one year from delivery on parts and labor on each component of the system. Finally, we ask that you refer to our web site (http://www.ing.iac.es/~eng/standards/design/inginst.htm) to review the standards established for quality and compatibility with the observatory and which are applicable in their relative parts to this order. The items that we wish to purchase for use with EEV42 CCD devices are:-

1.0 **Two complete SDSU phase II Controllers**, constructed from the following modules and with the following characteristics:

1.1 Two of **Controller housing** fitted with minimum 48 pin male ccd connector, 3 x DB15 female general purpose connectors, power connector, 6 board backplane and wiring.

1.2 Two of **Power supply sub system** for 240v ac +/- 10%, 50Hz operation, capable of supplying all power required by the SDSU controller in its maximum configuration, 12v dc @ 1.5 amp floating supply for shutter and temperature control. Supply to Controller cable with a minimum of 2.5mtr length.

1.3 Two of **Power control board** compliant power and voltages of the phase II system.

1.4 Two of **Phase II timing board** with 50Mbit fiber downlink, 4Mbit uplink, both for use with 62.5 micron fiber, 20 nanosec sequencer resolution. DSP ROM to provide for host communication, host code download, basic system diagnostics. Should accept TTL level synchronization edge to initiate sequencer action.

1.5 Two of **Phase II Clock Driver board** capable of driving the full bandwidth of the sequencer over full load conditions (20Mhz into 50pf and 200KHz into 20nf in parallel with 5K?). RC Edge shaping must be provided for. Provision to quickly switch the clock drive voltages between two Hi/Lo voltage pair presets is required.

1.6 Four of **Phase II Video processing board** with full (1 MPixel ?) rate simultaneous conversion on both channels. 4 gains of 0, 3, 6, 9 dB, software selectable gain switching on at least 2 gains, input sensitivity <= 5 ? volt / lsb @ 9dB gain Minimum of 8 individual and very low noise bias voltages selectable between +/- 10v or 0-30v. Provision to quickly switch the bias voltages from two preset values via software. Less than 1lsb rms. noise on all gain settings with input star terminated with 20K? impedance and sequencer running 'normal' readout sequence into load using a 2 ? sec integrator time constant. Linear to 1lsb across dynamic range of input.

1.7 Two of **Phase II Utility board** to provide temperature control via analog current of max. 15 watts to resistive heater. Temperature sense to be via pt100 type sensor. temperature set range between 0 - 310 Kelvin with 0.1 Kelvin precision and 0.2 Kelvin stability. Additional temperature channel using a silicon diode sensor for low resolution sensing between 220 - 310 Kelvin. Shutter control and drive circuitry to provide two modes of operation. (a) pulse open / pulse close with pulse width variable between 50 - 1000ms @ 12v / 1 amp drive and (b) Level open / close with 12v 1.5 amp drive. Timing to be autonomous and accurate to 1ms between 0.5 sec to 4 hrs. Two open collector shutter status inputs to be provided. Shutter status should control timing interval. Measurement of shutter open / close times, as sampled from the status, should be available. Shutter drive state and returned status must be available. Telemetry for all bias and clock voltages, read out as volts, should be available at any time. The ability to set any bias voltage to a user defined level is required. One async serial communications port must be available and independent of the internal Timing board - Utility board comms link. Documented source code for the control program must be provided.

1.8 One of **Timing board Code example** to provide one, two and six channel readout of an (array of) EEV42 CCD(s). Code should be provided with a simple command interpreter to allow binning factors in X and Y of 1, 2, 4, 8 pixels independently, one user sizable window readout, selectable gain and speed. Code should provide a fast clear routine that will run 'n' complete clear cycles before returning. Code modules should be in documented source form, compilable via a Motorola cross compiler into a downloadable module.

1.9 Two of **complete set of documentation** for all components of the SDSU controller. This documentation must include as a minimum: brief overview of system with block diagrams and indicating signal / data flows, a complete schematic for each board, power supplies, cable harnesses, internal and external connectors, a detailed description of each boards functionality with relevant timing diagrams, a complete list of components and, if possible, their supplier.

In addition to the controller we require the following host adapter interfaces:

2.0 One complete **SDSU SBus Interface board** to accept the 50Mbit downlink and talk via the 4Mbit uplink to the SDSU controller. To be supplied with all relevant mounting hardware and software drivers compatible with Solaris 2.5 operating environment. Installation instructions, schematics diagrams and software driver operational description must be supplied.

3.0 Two complete **SDSU VME Interface boards** to accept the 50Mbit downlink and talk via the 4Mbit uplink to the SDSU controller. To be supplied with all relevant mounting hardware, documentation for all components of the board. This documentation must include as a minimum: brief overview of board with block diagrams and indicating signal / data flows, a complete schematic, internal and external connector assignments, a detailed description of the

boards functionality with relevant timing diagrams, a complete list of components and, if possible, their supplier. DSP ROM code should be supplied to communicate to the controller, upload controller code to the timing board, accept data from the downlink and store in external memory space, and perform self and controller diagnostics. ROM Code should be in documented source form, compilable via a Motorola cross compiler into a absolute binary executable image.

General considerations.

1. Since we share facilities and to some extent developments with the current Gemini project we require that all equipment supplied to us be, to the maximum extent, compatible with equipment supplied to the Gemini project via the Royal Greenwich Observatory.
2. If at all possible, the documentation for the systems should also be delivered in PC readable format as well as hard copies.
3. We would require limited availability (after all else fails !) of phone advice from a technical representative of SDSU. If this service is not normally considered as part of the package then please include this access for a one year period as a separately costed item.
4. Please supply an itemized qoute that lists individual prices and guaranteed delivery dates for equipment so as to facilitate our future planning. Where equipment is currently unavailable or with delivery date uncertain, please supply an estimated availability date so marked.

In Addition.

We wish to ask for your help in locating a 'person' who would help us to accelerate our implementation of SDSU controllers to our requirements. We are looking for a person to actively develop two areas that we consider essential to our rapid deployment of these controllers. The two areas are:- Timing board / Utility board DSP code development for adapting the controller to our detectors and, VME / VxWorks / Epics data acquisition and camera control systems development for SDSU controllers. We propose two possible ways in achieving this in order of preference:-

1. Invite a suitably qualified person to sub-contract at a fixed cost, one year of effort on our (paradise !) island to work at our facilities or,
2. Invite the CCD group at SDSU to develop under a fixed cost sub-contract the SDSU controller to our detailed specification.

In the first instance, if you could, with your knowledge of both the controller and of people working with it, suggest a particular person to contact else, in the second instance indicate your group's willingness or not to undertake such a contract, we would appreciate this very much.

Contact addresses.

For further information and as recipient for the expected quote please use the most indicated method of communication to:-

Peter Moore or Guy Woodhouse,
Telephone Observatory +34 22 405500
Sea level office +34 22 425400
Fax +34 22 405646
Home +34 22 413945
Email pcm@ing.iac.es or guy@ing.iac.es
Smail Isaac Newton Group, Apartado de Correos 321,
38780 Santa Cruz de La Palma, Canary Islands, Spain.