MICROGATE

KECK NEXT GENERATION WAVEFRONT CONTROLLER

Real Time Controller
User Manual

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CHANGE RECORDS

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1 ACRONYMS

AO Adaptive Optics
CCD Charge Coupled Device
CIE Command Interpreter and Executer
COTS Commercial Off-The-Shelf
DDR Double Data Rate
DM Deformable Mirror
DMA Direct Memory Access
DSP Digital Signal Processor
DTT Down Tip Tilt
DTTM Down Tip Tilt Mirror
FC-IP FibreChannel Internet Protocol
FITs Number of Failures in 10^9 hours
FPDP Front Panel Data Port
GPIB General Purpose Interface Bus
HBA Host Adapter Board
HP Width unit for 19” chassis, corresponding to 0.2” (5.08mm)
HV High Voltage
HVA High Voltage Amplifier
HVC High Voltage Control
ICMP Internet Control Message Protocol
IIR Infinite Impulse Response
LFpM Linear Feet per Minute
LAN Local Area Network
LGS Laser Guide Star
LUT Look Up Table
MAC Multiply And Accumulate
mas milliarcseconds
MGAOS Microgate Adaptive Optics real-time System
MIMO Multiple Input Multiple Output
MIL-STD military standard
MMF Multi-Mode Fiber
NDA Non Disclosure Agreement
NFS Network File System
NGS Natural Guide Star
NGWFC Next Generation Wavefront Controller
PCB Printed Circuit Board
PIO Programmable Input Output

PSU	Power Supply Unit
RMS	Root-Mean-Square
RTC	Real Time Controller
SAN	Storage Area Network
SAS	Serial Attached SCSI
SCSI	Small Computer System Interface
SFP	Small Form factor Pluggable
SI	The International System of Units
SH	Shack-Hartmann
SRAM	Static Random Access Memory
SDRAM	Synchronous Dynamic Random Access Memory
STRAP	System for Tip-tilt Removal with Avalanche Photo-diodes
TBC	To Be Confirmed
TBD	To Be Defined
TRS	Telemetry Recorder/Server
U	Height unit for 19” chassis, corresponding to 1.75” (44.45mm)
UTT	Uplink Tip Tilt
UTTM	Uplink Tip Tilt Mirror
VME	VersaModule Eurocard
WBS	Work Breakdown Structure
WCP	Wavefront Controller Command Processor
WIF	Wavefront Controller Interface
WFP	Wavefront processor
WFS	Wavefront Sensor

2 APPLICABLE DOCUMENTS

[AD1] CARA/W.M. Keck
NGWFC RTC Requirements – Keck Adaptive optics note #311. Version 1.0, March 11th, 2005

[AD2] CARA/W.M. Keck
NGWFC RTC Tip-Tilt Requirements – Keck Adaptive optics note #329. Version 1.0, May 25th, 2005

[AD3] CARA/W.M. Keck
NGWFC RTC Vendor Statement of Work – Keck Adaptive optics note #310. Version 1.0, March 11th, 2005

[AD4] CARA/W.M. Keck
NGWFC System Design Manual – Keck Adaptive optics note #289. Version 2.0, August 15th, 2005

[AD5] Microgate S.r.l.
Real Time Controller Preliminary Design Review Data Package
Issue 1 – August 22nd, 2005

[AD6] CARA/W.M. Keck
Request for change to the NGWFC RTC: Post PDR updates - Keck Adaptive optics note #354. Version 1.4, Novemeber 3rd, 2005

[AD7] CARA/W.M. Keck
NGWFC RTC Acceptance Test Plan - Keck Adaptive optics note #374

[AD8] CARA/W.M. Keck
NGWFC Detailed Design Report - Keck Adaptive optics note #371
December 2nd, 2005

3 REFERENCE DOCUMENTS

[RD1] R. Biasi, M.Andrighettoni et al. - 'Dedicated flexible electronics for adaptive secondary control', - SPIE Proc. on 'Advancements in Adaptive Optics', 5490, p.1502

[RD2] E-mails exchanged between Microgate and CARA-Keck between April 21st ad May 7th, 2005

[RD3] Department of Defense USA, MIL-HDBK-217 Revision F, Reliability Prediction of Electronic Equipment

[RD4] Keck AO Wavefront Control –Hardware Manual

[RD5] INCITS - FibreChannel – Physical and Signaling Interface – ANSI – INCITS 230-1994

[RD6] M. Rajagopal, R. Bhagwat, W. Rickard - RFC 2625 - IP and ARP over FibreChannel - June 1999

4 INTRODUCTION

This document contains information on how to install and setup the RTC system.

4.1 SYSTEM DESCRIPTION

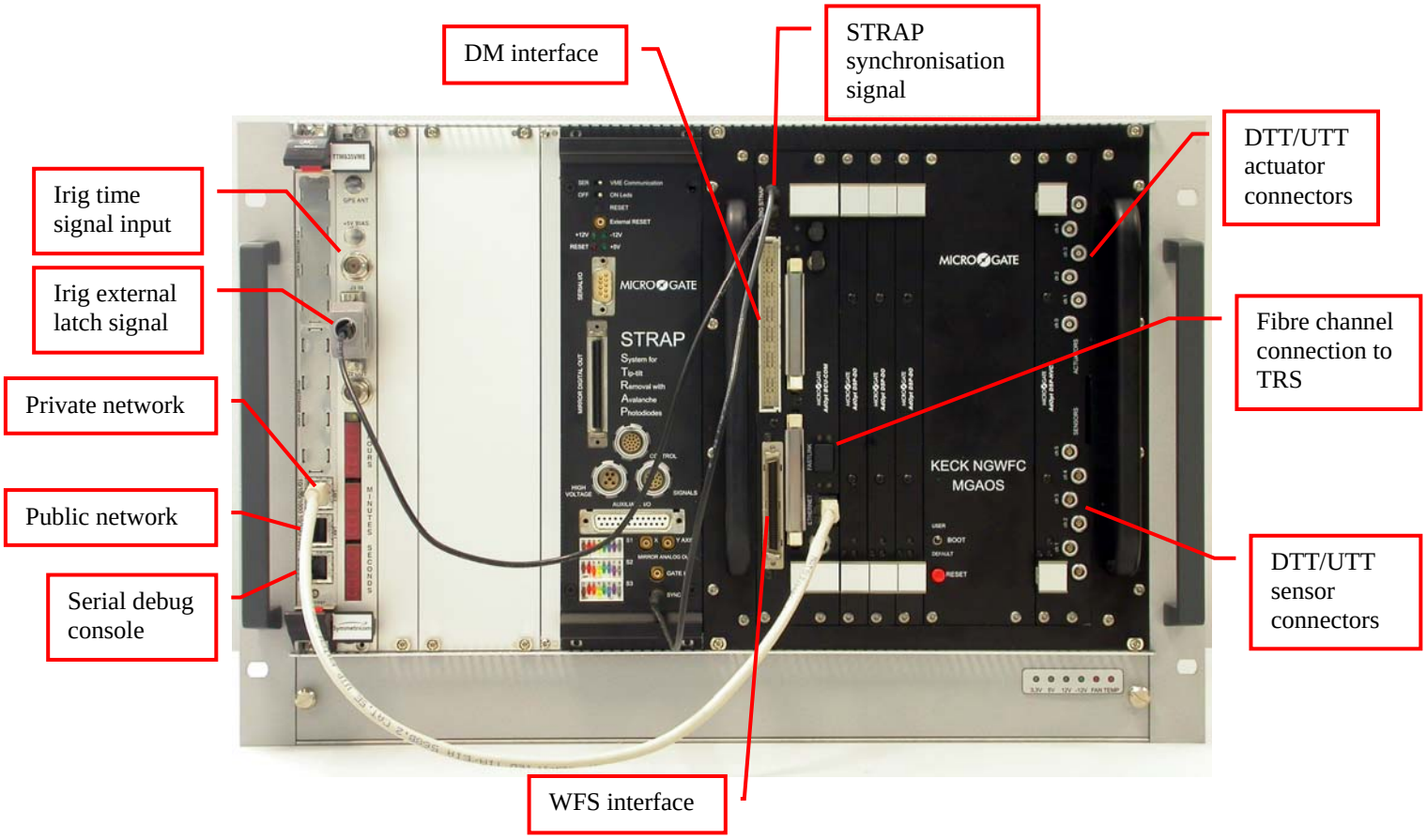
The RTC system is divided on the following subsystems:

- VME CRATE including MGAOS crate
- TRS (SUN X4100 and TRITON disk array)
- HV driver power supply

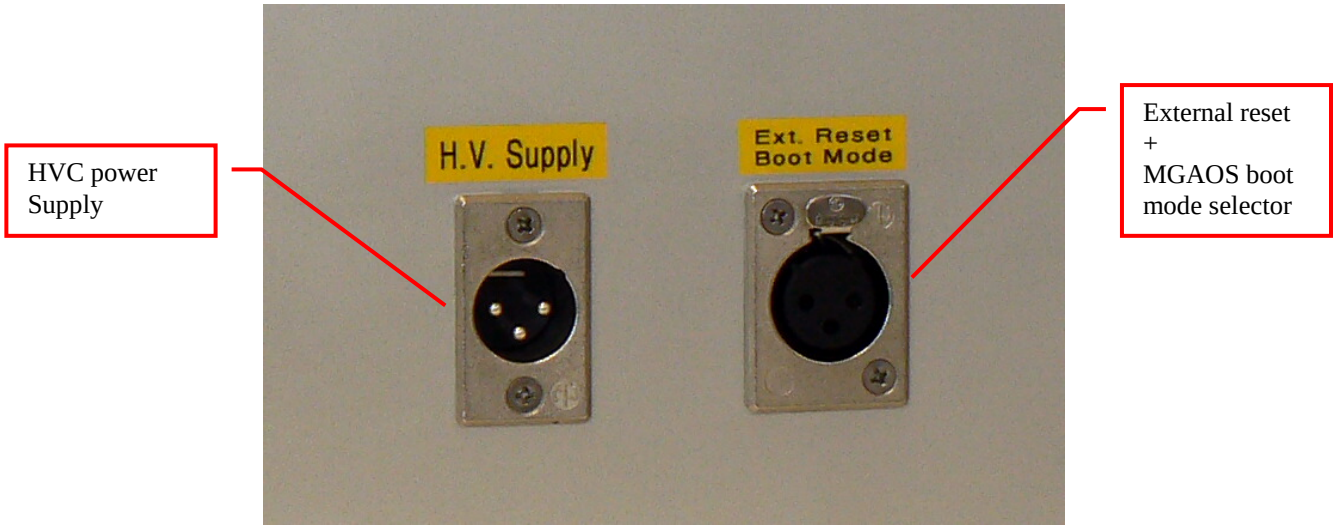
5 HARDWARE INSTALLATION

5.1 MVME CRATE/MGAOS

The following picture illustrates all front panel interfaces of the MVME CRATE/MGAOS.



The following picture illustrates the rear panel interfaces of the MVME CRATE/MGAOS.



5.2 TRS

The TRS is based on a SUN X4100 server and a TRITON 16FA disk array. See picture below.

The X4100 server has two Qlogic fibre channel devices one is connected to the disk array the other is connected to the MGAOS system.

Important: a green led indicates the fibre channel link is ok.

The X4100 must be connected to the network in order to allow remote connection's from MVME system and other clients. The default network link is net0 configured as 192.168.0.246

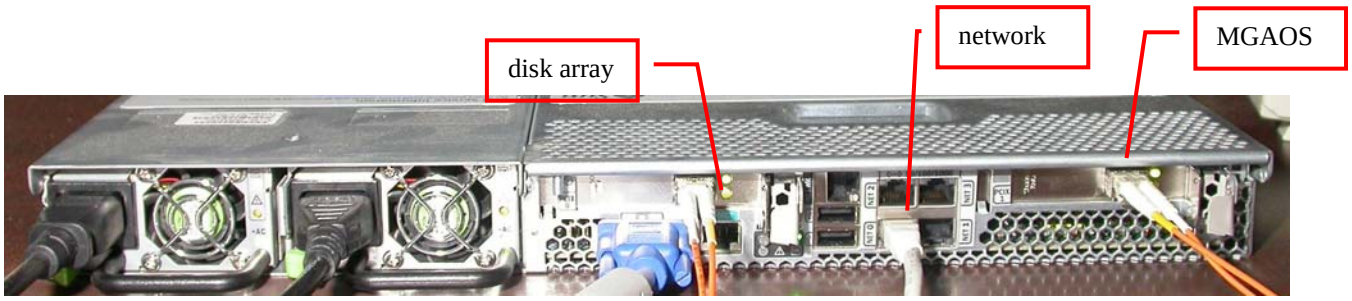


Figure 1 – SUN X4100 server.

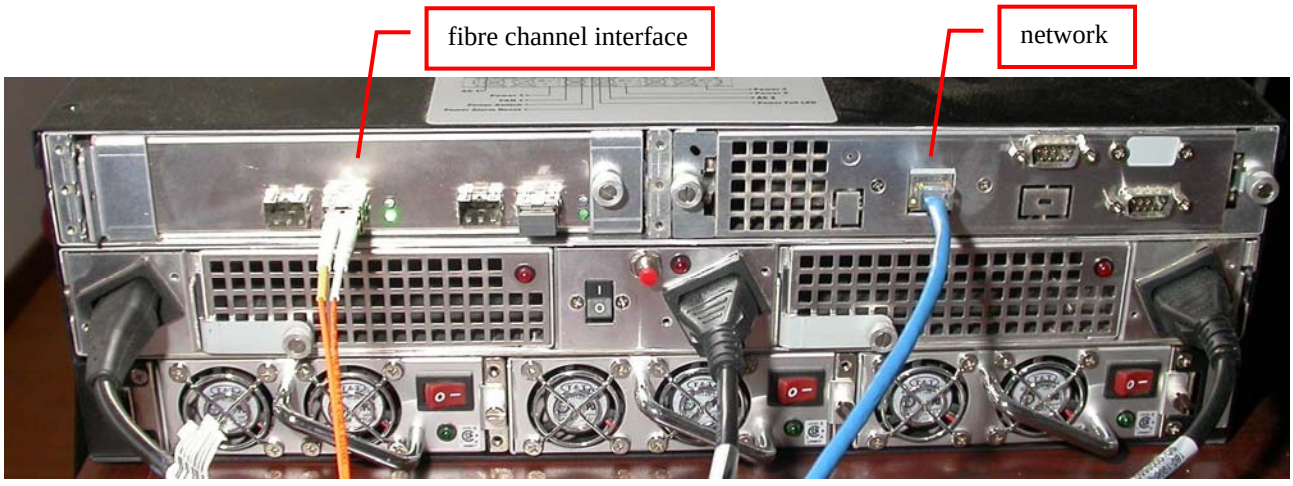


Figure 2 – 16FA Triton disk array.

The disk array contains 16 400GB Hitachi disks. The disks are automatically recognized by its serial number the position where the disks are inserted doesn't matter.

The disk array can be configured remotely through a web browser if it is connected to the network.

5.3 HVC

6 SOFTWARE INSTALLATION

6.1 MVME CRATE/MGAOS

The MVME software is automatically loaded from a ftp server (please refer to the maintenance manual for details). After the VxWorks operating system is loaded and started a bootscript is automatically executed. This bootscript controls the user level software loading and starting. The MGAOS dsp codes are downloaded by the MVME software. Basic system functionality tests are automatically perfomed during the boot procedure. When the system has succesfully finished to execute the bootscript, it will be in standby, with default parameters loaded. At this point the system is ready to be operated through the WIF interface, please refer to the WIF command table for available commands.

In order to understand if the system is ready to be operated refer to SYSTEM CHECK chapter.

For further details on software setup please refer to the maintenance manual.

6.2 TRS

The TRS server runs Solaris 10 operating system. On the TRS there are two main software parts: the postgresql database engine and the storage client.

The postgresql database runs as the *postgres* user while the storage client runs as *trs* user.

The postgresql database is installed in */export/home/postgres/data* all configuration is here while the „real data“ is stored on the disk array which is mounted on */mnt/big*

The storage client software is in */export/home/trs/trs-0.8.1*. The compiled postgresql extensions are placed in */export/home/trs/pg_extension*

Table 1 summarize all TRS user and its rule

user	password	rule
root	fire20x	general administration
postgres	postgres has no password. In order to login as root execute this command: *# su – postgres* *Sun Microsystems Inc. SunOS 5.10 Generic January 2005* *-bash-3.00$*	start/stop database engine *-bash-3.00$ /usr/bin/pg_ctl start* *-bash-3.00$ /usr/bin/pg_ctl stop* *-bash-3.00$ /usr/bin/pg_ctl status*
trs	fire20x	start/stop storage client *bash-3.00$ /export/home/trs/trs-0.8.1/ctl start* *bash-3.00$ /export/home/trs/trs-0.8.1/ctl stop* *bash-3.00$ /export/home/trs/trs-0.8.1/ctl status* build storage client software *-bash-3.00$ pwd* */export/home/trs/trs-0.8.1* *-bash-3.00$ gmake* clear database *-bash-3.00$ pwd* */export/home/trs/trs-0.8.1* *-bash-3.00$ psql -d trs < cleartables.sql* database work with psql *diti:~$ psql -h 192.168.0.247 -d trs -U trs*

		Welcome to psql 7.4.12, the PostgreSQL interactive terminal. *Type: \copyright for distribution terms* *\h for help with SQL commands* *\? for help on internal slash commands* *\g or terminate with semicolon to execute query* *\q to quit* *trs=#*
admin	00000000	disk array user for the TRITON configuration through web browser
	config	QLogic SANSURFER configuration password for this tool: *bash-3.00# /opt/QLogic_Corporation/SANsurfer/SANsurfer*

Table 1 – TRS user table

Note: the postgresql and storage client are not started automatically at boot, they must be started manually. If needed both could be started automatically by an init script.

7 SYSTEM CHECK

After the VxWorks operating system is loaded a user bootscript is executed. This bootscript contains some routines for system checking. For instance the presence of all the MGAOS boards is checked, the firmware of the MGAOS, communication with TRS and BCU and so on are checked. The status of the system can be displayed at any time calling the *wifAutoCheckDisplay* routine:

```
-> wifAutoCheckDisplay
                        BCUPing:  OK
                        TRSPing:  FAILED
          MGAOSCrateConfiguration:  NOT TESTED
                  BCUNiosVersion:  NOT TESTED
                 BCULogicVersion:  NOT TESTED
                  DSPNiosVersion:  NOT TESTED
                 DSPLogicVersion:  NOT TESTED
                  HVCNiosVersion:  NOT TESTED
                 HVCLogicVersion:  NOT TESTED
               HVCCodeRunningCheck:  NOT TESTED
                        BCUCode:  NOT TESTED
                        DSPCode:  NOT TESTED
                        HVCCode:  NOT TESTED
                  frameInterrupt:  NOT TESTED
                    fibreChannel:  NOT TESTED
```

The functionality or name of the test is displayed together with its result which can be *OK*, *FAILED* or *NOT TESTED*. A test can simply be executed calling the *wifAutoCheckRun* routine which takes the name of the test as an argument. For instance

wifAutoCheckRun("BCUPing")

tests the communication with the BCU. It is also possible to run all tests at a time by supplying ALL as argument:

wifAutoCheckRun("ALL")

In addition of these automatic tests in case of an error the full function calling stack is reported, indicating the function wich causes the error, filename and number of the code where the error occured. Often just the logging messages helps to find the cause of the problem. If the WIF software is not build with debug flags no messages should be printed to the console, if there are any they should be understood and not ignored.

The following table lists for each automated test the possible cause in case of a problem:

test name	short test description	possible cause
BCUPing	*tests if the MVME can comunicate with MGAOS* *A ping to the BCU is executed*	Cabling problem; Wrong IP address configuration; MGAOS BCU has problems; MVME has problems;
TRSPing	*tests if the MVME can*	Cabling problem/Network problems;

	comunicate with the TRS *A ping to the TRS is executed*	Wrong IP address configuration; TRS has problems / is down; MVME has problems;
MGAOSCrateConfiguration	*Tests if all boards of the MGAOS are present and inserted in the right slot*	Board not properly inserted; Board inserted in the wrong slot; Board has problems;
BCUNiosVersion	*Checks that the BCU is using the correct Nios code version*	Wrong configuration; MGAOS user/default switch is in the wrong position; Board boot problems;
BCULogicVersion	*Checks that the BCU is using the correct Logic version*	Wrong configuration; MGAOS user/default switch is in the wrong position; Board boot problems;
DSPNiosVersion	*Checks that all the DSP board are using the correct Nios code version*	Wrong configuration; MGAOS user/default switch is in the wrong position; Board boot problems;
DSPLogicVersion	*Checks that all the BCU are using the correct Logic version*	Wrong configuration; MGAOS user/default switch is in the wrong position; Board boot problems;
HVCNiosVersion	*Checks that the HVC is using the correct Nios code version*	Wrong configuration; MGAOS user/default switch is in the wrong position; Board boot problems;
HVCLogicVersion	*Checks that the HVC is using the correct Logic version*	Wrong configuration; MGAOS user/default switch is in the wrong position; Board boot problems;
BCUCode	*Checks that the BCU board has the right DSP code*	Wrong configuration; Code download problems;
DSPCode	*Checks that alle the DSP boards have the right DSP code*	Wrong configuration; Code download problems;
HVCCode	*Checks that the HVC board has the right DSP code*	Wrong configuration; Code download problems;
HVCCodeRunningCheck	*Checks that the DSP code on the HVC is running; this check is only available for the HVC board.*	The MGAOS has been resetted manually: needs a reeinitialization which can be done by the RESET wif command MGAOS initialization has failed; The HVC board has problems; The MGAOS board has problems;
frameInterrupt	*Checks that the MGAOS can send an interrupt and this is received by the Irig.*	Cabling problem; Problem on Irig board; Problem on the MGAOS; MVME problem;
fibreChannel	*Checks that the MGAOS can send data through fibre channel to the TRS*	Cabling problem; Storage client (trsd) on the TRS is down: try with:

		-bash-3.00$ ./ctl *trsd seems to be running - the current status is:* *6626, 10, 10, 10, 10* Try to ping the MGAOS from TRS: *# ping 192.168.1.60* *192.168.1.60 is alive* Problem on the MGAOS; Problem on the TRS

Table 2 – Autocheck failure table