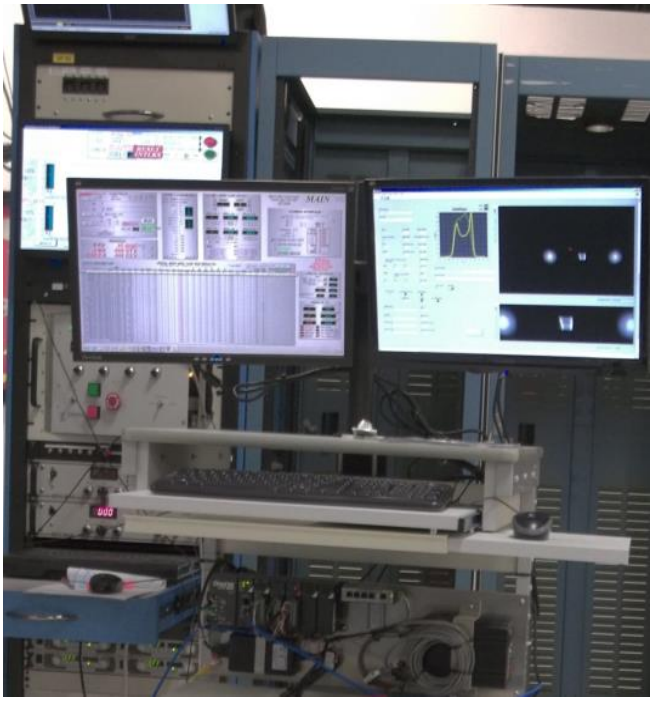
VARIAN medical systems	X-RAY PRODUCTS – PRODUCT DOCUMENTATION MCS-2093 AUTO GRID TEST EQUIPMENT MANUAL **Equip # XT229**		
	Owner(s)	**Document Number**	**Revision**
	HI CT MFG Department	**20004412**	**-**

ECO # - Description	Revision Date
ECO #– Establish	08/16/2016

CAMERA-TUBE & GRID TANK



COMPUTER CART & RM15 CNTRL

HI CT MCS-2093 AUTO GRID TEST MACHINE SPECIFICATION

John Graham, P.E.

Aug 16, 2016

DISTRIBUTION:

1. **John Graham**
2. **John Graham**
3. **XT666 comp cart**
4. **Nick Marietti**
5. **Ted Hatch Cal**
6. **Maint Bart Summers**
7. **Maint Bart Summers**
8. **Jake Sullivan**
9. **Nick Schwinn**
10. **Paul McDaniels**

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1.0 MACHINE FUNCTION

The ***HI CT Mcs-2093 Auto Grid Test*** set performs grid and focal spot tests on the dual grid MCS-2093 tube built for Arineta (Israel). The machine consists of ***Computer Cart*** , ***Grid Tank***, and ***Flat Panel***

Pinhole Camera together with a ***REM***ote control analog interface to HV Stn #15. The option exists to use this test set with Rooms 14 and 16 in the future. Arineta requires an extensive test data package which gives them starting points for their system calibration when installing new tubes. This test set measures Grid Cutoff voltage to 5 KV (G1=G2). It measures the grid ***Bias*** (G1=G2) required to narrow focal spot width from 1.4 mm to 0.7 mm. It measures ***+X focal spot deflection*** (G1=2*Bias,G2=0) and ***–X focal spot deflection*** (G1=0,G2=2*Bias). X and Z axis position readings are measured relative to the 1313DX panel center pixel. Magnification is measured directly using two outboard 2mm holes spaced a known 13.0 mm apart. Y axis depth is geometrically calculated using observed magnification and known port face to pinhole to panel spacing. The system computer controls the HV power supply in Room 15 to give 350 mS nominal pulse exposures which limit MCS-2093 target temperature rise to about 5 deg C per exposure. Full **A**cceptance **T**est **P**rocedure data sheet generation requires about 175 exposures, yields 72 data items, and takes about 15 minutes. Multiple csv data logs record *Grid Tank Run Results Log*, *Data Sheet Log*, and an abbreviated ***A****utomatic* ***D****ata* ***C****ollection Log* to track long term trends. Engineering test functions also support *Emission Test*ing and *X-Z-Y Thermal Drift*. A Varian Paxscan 1308DX flat panel is used in place of the original Gemini Paxscan 1313 and is rotated 90 degrees CW to accommodate the reduced rectangular viewing area of the DX. The stepper motor Pinhole Positioning System is not used, but pinhole height may be adjusted manually for magnification other than the current 3.5X. A 75 micron pinhole is used and Outboard mag holes are covered by 1/24" lead***. Frame rate and Mode are specified for each exposure and should be adjusted for peak pixel count values between 10,000 and 50,000***. John Graham designed the Grid Tank, Computer Cart, and ***REM***ote HV Stn control interface as well as programmed the ThinkNdo computer supervisory system. The Flat Panel Pinhole Camera is the (modified) Gemini Flat Panel, and Nick Marietti programmed the Labview *Flat Panel Camera Interface* which captures and analyzes focal spot images and hands off data values to the ThinkNDo program via OPC Server.

2.0 EQUIPMENT

2.1. Components:

COMPUTER CART: The Windows 7 32 bit OS computer has dual 22" monitors. A Think & Do 8.1USB control application program communicates to an I/O Rack which supplies ***REM***ote control of HV Station 15 HV & filament drive power supplies, together with flat panel ***User Sync***. A (Marietti) custom LabView executable program controls Flat Panel Camera focal spot image acquisition, focal spot analysis, and OPC interface to the ThinkNdo control program. Refer to schematic C01309322093 sh3.

GRID TANK: A 12" x 18" x 18" oil tank adds dual 10KV Grid Supplies to the MCS-2093 cathode circuit operating at -150KV cathode potential. RS232 control of the tank uses a fiber optic datalink for HV isolation with update rates for six signals at 5Hz. Grid tank operating power is parasitically derived using a circuit in series with the tube filament. This requires 5Vac additional voltage compliance from Room 15 filament supply (25VEfDr), but gives accurate filament current readings for emission testing.

FLAT PANEL CAMERA: A 1308DX panel is mounted (90 deg CW rotation) on the (existing) Gemini camera frame and uses a 75 micron pinhole to image focal spots along with two 2 mm outboard holes 13.0 mm O.C. which directly measure magnification and (calculated) Y axis depth. These outboard holes are covered with 1/24" lead to avoid panel saturation. ***User Sync*** connector utilizes ***user sync blanking*** for aquiring individual image frames. To cover a wide dynamic range of exposure levels while limiting focal spot pixel intensities to 10,000-50,000 counts, frame rates may be scheduled from 1.26 to 41.7 Hz (33:1 range) and Mode=0, 1, 2, 3, or 4 is specified selecting 0.5 pF, 1.0 pF, 2.0 pF, 3.0 , or 4.0 pFcharge amplifier integrating capacitors (8:1 range). ***Use the shortest exposure (highest Hz) practical to limit heat rise and adjust mode AR for 10,000-50,000 peak pixel counts***. An ethernet cable links the camera to Nick's LabView program, which captures and processes frame images and hands data off to the ThinkNdo OPC server for use by the ThinkNdo control application program.

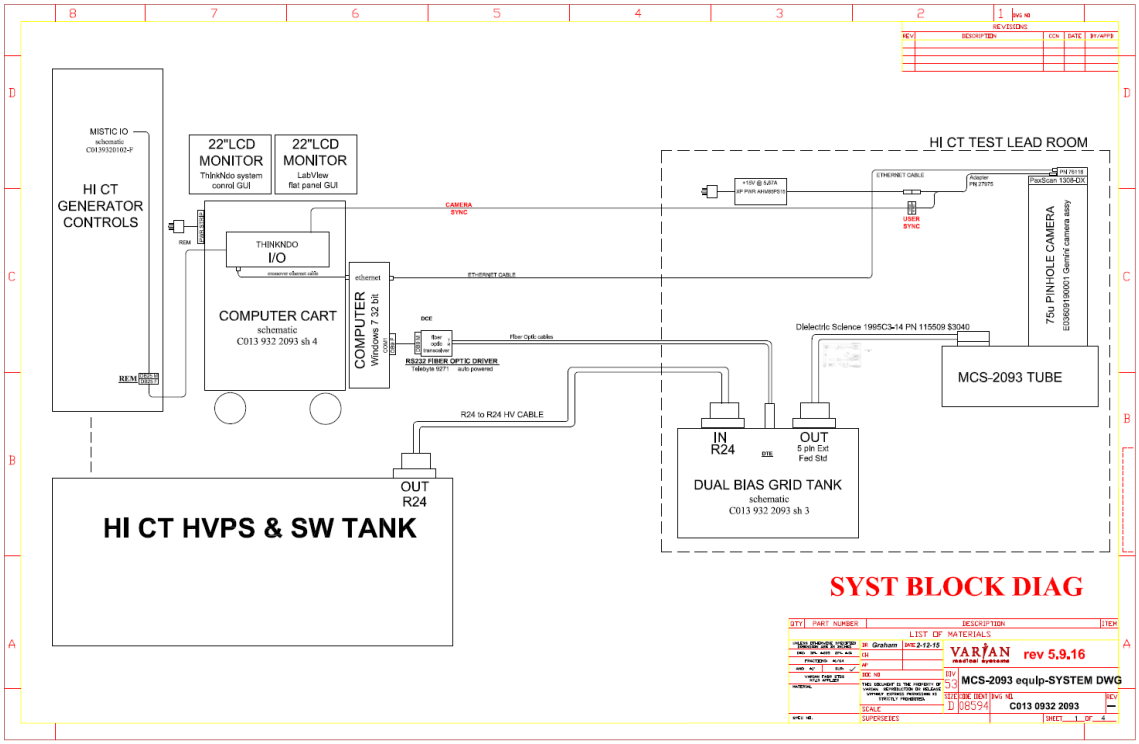
2.2. Utilities:

120 Vac outlets: (1) required outside HV Room for the computer cart, and (1) inside the HV room for the flat panel.

3.0 SET-UP

3.1. Initial Installation:

refer to C01309322390 sh1 SYST BLOCK DIAG for details.



SYST BLOCK DIAG ILLUSTRATES INITIAL INSTALLATION

COMPUTER CART: plug power strip to 120 Vac, connect ***REM*** DB25F to HV Stn ***REM*** DB25M, connect COM1 DB9F to DB9M on RS232 fiber optic driver, OR & BLU fiber optic cables to the Grid Tank, connect the 50' ethernet cable to the flat panel, and connect the ***User Sync*** DB9F to the flat panel adapter DB9M.

NOTE: **Proper HV cable termination is CRITICAL to an operating system to not arc and damage sensitive electronic circuits. Please obtain training from Tim Boman for R24 to R24 cable termination, Nick Schwinn for Ext Fed Std cable termination, and Nick/Jake Sullivan for MCS-2093 tube HV cable termination.**

GRID TANK: connect R24 to R24 HV cable from Switch Tank, side 1 or side 2 AR, to the Grid Tank R24 HV ***IN***. Connect fiber optic cables to computer cart per above, and connect HV ***OUT*** cable to the MCS-2093 tube.

FLAT PANEL CAMERA: plug in +15Vdc power supply and connect to 1308DX panel via #27975 adapter. Connect ***User Sync*** to computer cart (above). Connect ethernet to computer cart (above). Mount camera to MCS-2093 port face using adapter plate.

3.2. Start-up:

HV Stn #15: load TubeType #37 ***MCS-2093 w/ GRID TANK***, enter ***SN***, ***OPER***, and select Sched 193 ***GRID TANK SETUP***.

Computer Cart: start computer, double click 

starts the ***ThinkNDo*** control program and ***Main.VI*** Labview program. Following instructions in Operation below, select ***TUBETYPE***, enter ***SN***, enter ***OP***, select ***SCHED***, and click ***RUN***. If there are no issues with tube testing, operation is automatic and the selected schedule runs to completion. If a step ***Fails*** it will automatically ***Retest*** n times. After a Run is complete, individual steps may be manually ***Retested*** if desired.

4.0 OPERATION

Per 1.0 MACHINE FUNCTION, above, this automatic test set performs a sequence of complex tests and measurements characterizing the MCS-2093 per Arineta requirements. Equivalent testing done in the Lab takes an engineer 1-2 days and is not practical for HI CT production personnel. This Test Set was developed in order to transfer the MCS-2093 from engineering development to manufacturing production.

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Operating Instructions:

SETUP TUBE, H.E., ADAPTER PLATE, CAMERA: Roll an ***engine stand*** mounted tube in front of ***buggy stand*** 1 (left) or ***buggy stand 2*** (right), using the position which the ***Grid Tank R24 input HV*** cable is attached to on the ***Switch Tank***. Install the appropriate HV adapter cable from the ***Grid Tank Ext Fed Std output*** receptacle to the tube. ***NOTE:*** **Proper HV cable termination is CRITICAL to an operating system to not arc and damage sensitive electronic circuits. Please obtain training from Tim Boman for R24 to R24 cable termination, Nick Schwinn for Ext Fed Std cable termination, and Nick/Jake Sullivan for MCS-2093 tube HV cable termination.** Install the required Heat Exchanger, connect hoses to tube, connect to room J-Box **HE1** or **HE2** connector using a 9 pin HE cable, and turn on the respective **HE PWR** switch. The HE flow switch is sensed and tells Room 15 a housing is installed. Connect the tube stator connector to J-Box **STAT1** or **STAT2** using a suitable 9 pin cable. If a tube thermal switch or pressure switch is detected it also lets the room know that a housing is installed in that position. ***NOTE:*** **Verify that HV cable, HE cable, and stator cable all consistently use the same tube position, either #1 or #2.** Screw the camera adapter plate to the tube port face and clamp the camera body to the adapter. ***NOTE:*** **align CATHODE labels on both adapter and camera body with the tube HV connector, which is the cathode.** Close the room door and reset interlocks on Room 15 ***MAIN*** screen.

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Camera, Adapter, Tube, & Tank

Camera-Adapter-HV orientation

SETUP RM15 HMI: TUBETYPE, SN, SCHED, START STATOR → *Proc OK:* select the correct tubetype which loads stator and Heat Integrator parameters, enter SN & Operator, and select a nominal schedule. The schedule is not run but allows ***ProcNOK*** to reset to ***ProcOK***. Start stator LoSpd and check ***STATUS*** screen, etc. as required until all process interlocks are satisfied → Proc OK . You are now ready to start a Grid Tank system run.

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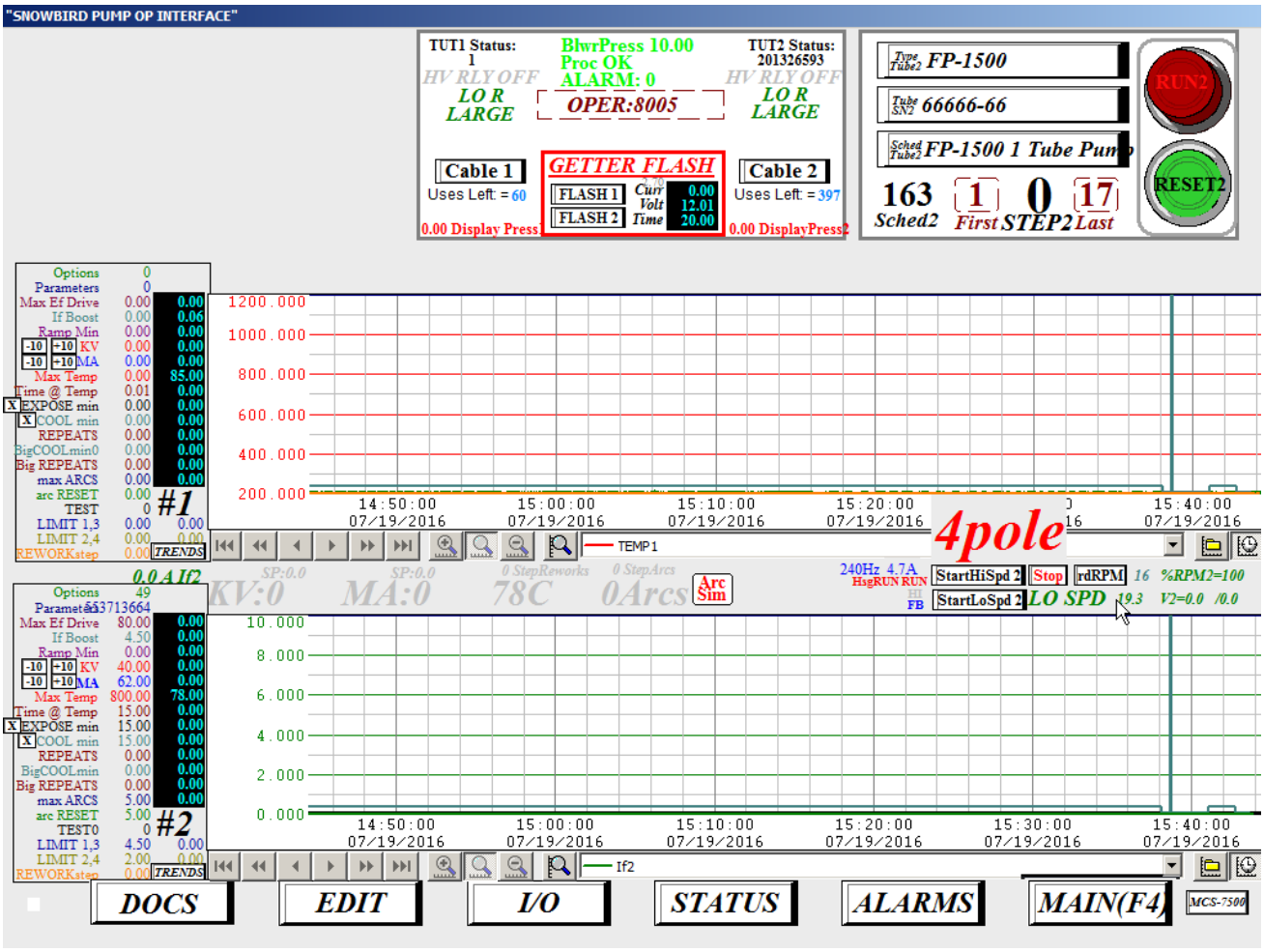
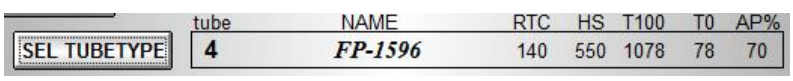


ROOM 15 MAIN SCREEN READY TO BE RUN REMOTELY BY THE GRID TANK SYSTEM

SEL TUBETYPE, INPUT SN & OPER#, SEL ATP SCHED# 5, and RUN:

Select Tubetype →



Enter Serial Number → ENTER SN 51246-M12

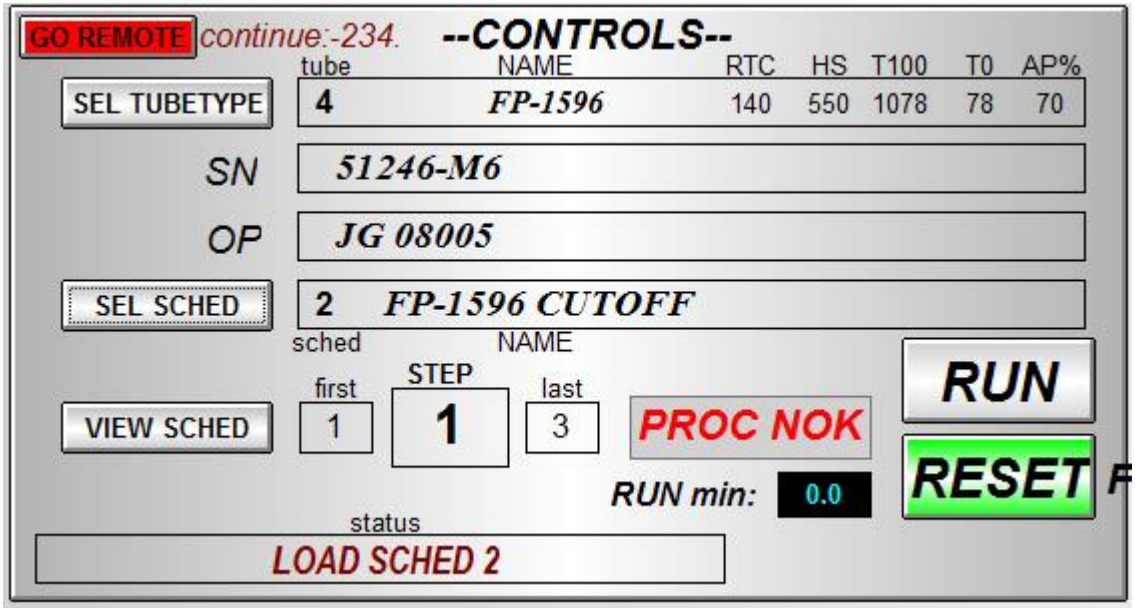
Enter Operator → 

Select Schedule → 

Change ***first*** and ***last STEP*** if desired → 

Click 

to begin Run.



***CONTROLS* (*MAIN*) READY TO BEGIN RUN**

OBSERVE 15 MIN ATP'RUN RESULTS PROGRESSION FOR PROBLEMS:

It is important to stay and observe operation of the test for proper operation. Grid Tank damage due to arcing tubes is the biggest potential problems. Use the oscilloscope program on Room 15's top monitor to detect abnormal arcing and stop testing if a tube is 'active' or has not been Housing Test processed on other HI CT 60 Hz HV Stations. **This is a delicate, precision system, not suitable or appropriate for processing *'ratty'* tubes**. Improper ***init***

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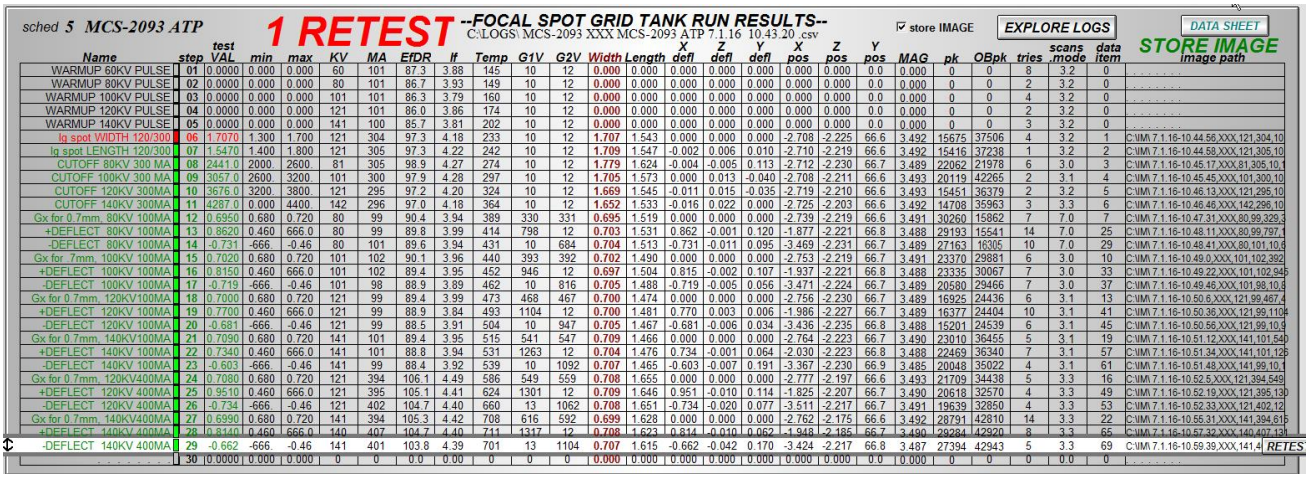
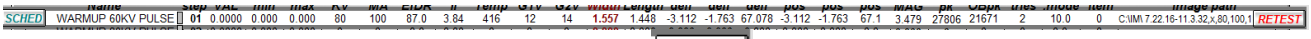
EfDr and ***init BIAS*** step variables may cause excessive ***'hunting'*** exposures or repetitive step Failures and Retests. Please report schedule problems to Jake Sullivan for resolution. Gain settings on the LIMITS screen may require adjustment, please report these to John Graham for resolution.



PLEASE OBSERVE FOR PROPER OPERATION DURING ENTIRE DURATION OF TEST

MANUAL RETEST PROBLEM STEPS:

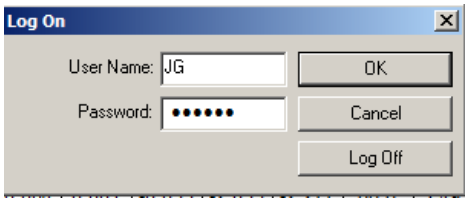


Click on focus bar and drag to desired step. Click RETEST to re-Run just this step while leaving other step results untouched.

DATA SHEET 'SCREEN SHOT' DOCUMENTS RUN, CSV DATA LOGS:

Run ***Screen Hunter*** (IO/Docs screen) in the background and click DATA SHEET on ***MAIN*** to access ***DATA SHEET*** screen. Hit F9 and use ***Screen Hunter*** to capture the desired screen shot. Run ***Word*** (IO/Docs screen) to open a document and paste the screen shot into. Retrieve the document with a USB flash memory drive. CSV data logs may be accessed via EXPLORE LOGS (***MAIN***), EXPLORE DATA SH LOG, and EXPLORE ADC LOG (***Data_Sheet***). Refer to directions in HMI instructions, these filesmay also be copied to USB drive depending upon requirements.

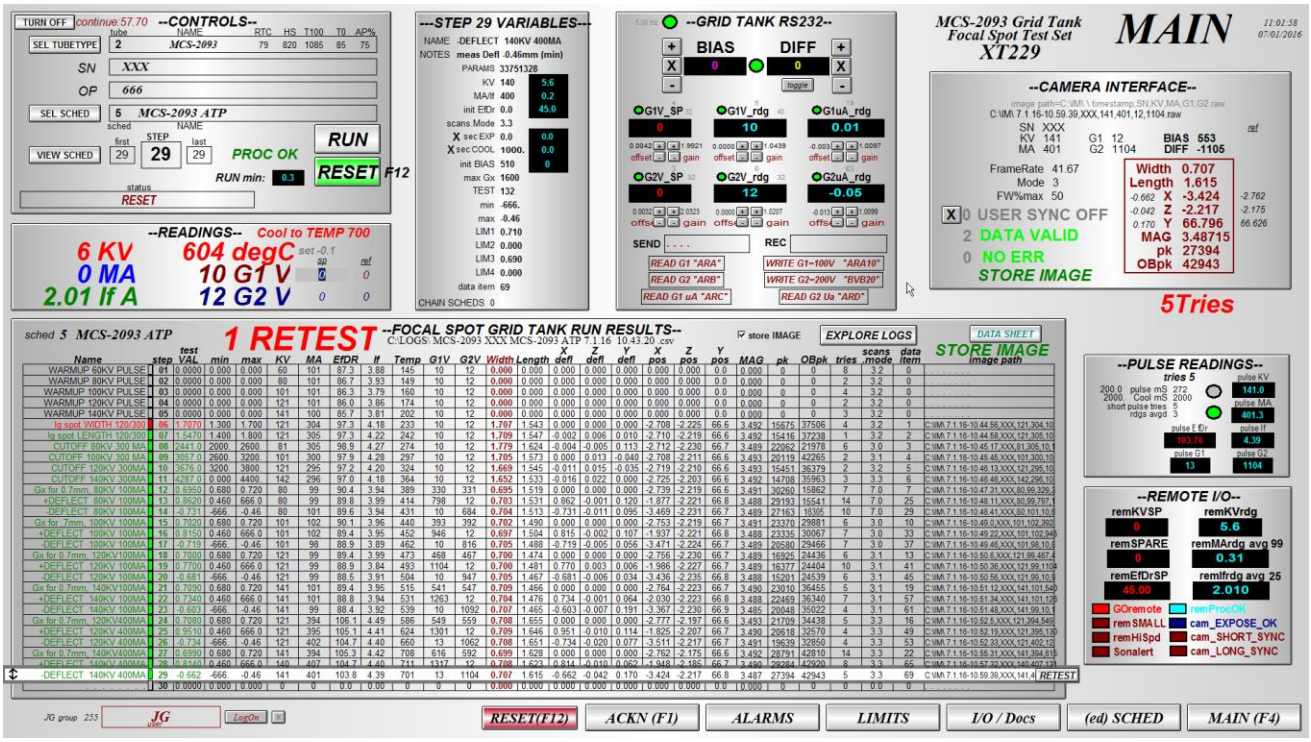
HMI Instructions:



ITEM: ***SECURITY SYSTEM LOGIN***, accessed from most screens

DESCRIPT: ***OP*** group level 100 is limited to basic RUN operations while ***JG*** group level 255 is permitted to perform all editing and higher level functions.

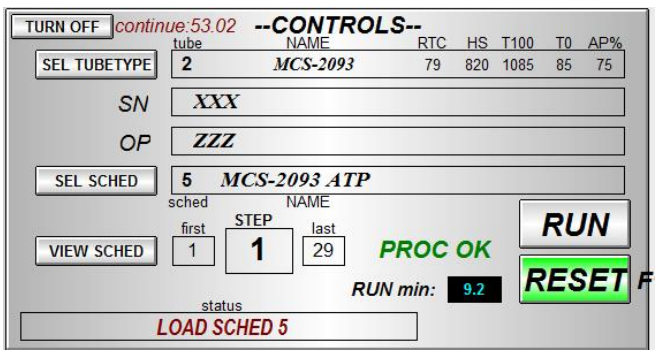
USE:  resets security level to ***OP***. Click  and enter User Name & Password to access higher level JG group functions. Reset to ***OP*** when done. ***'Entry allowed'*** data items are assigned a security, 0-255. ***If the current security level is not high enough, the item will not respond.***



ITEM: ***MAIN*** **screen accessed from most screens →** *MAIN (F4)*

DESCRIPT: Start system, load *TUBETYPE*, *SN*, *OP*, *SCHED*, first and last *STEP* → *RUN*. Displays system Status and test results as Run proceeds.

USE: Typical operator and engineering use items are illustrated:



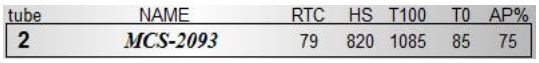
(MAIN **screen)** ***--CONTROLS--***

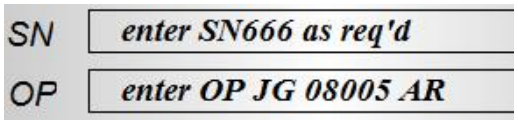
TURN SYSTEM OFF/ON: 

turns off ***GoRemote*** → Behlman and HV OFF. Automatically turns back on when ***RUN*** is hit or manually 

SELect TUBETYPE: 

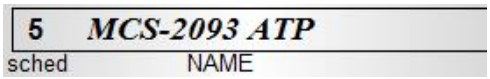
→ 

→ 

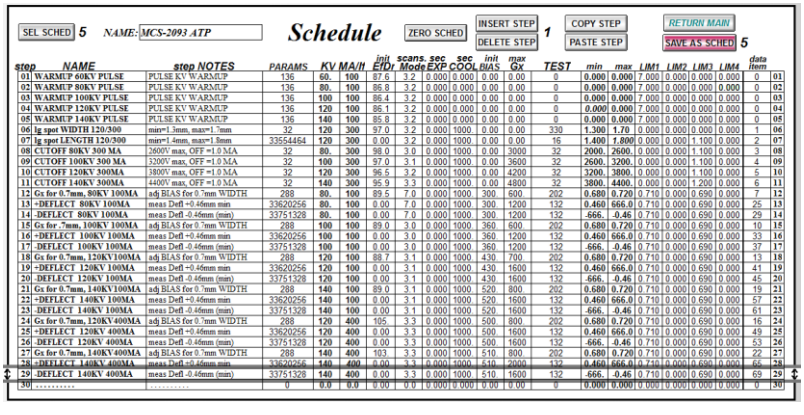
INPUT Serial Number and Operator #: → 

SELect SCHedule: 

→ 

→ 

VIEW SCHedule: 

→ 

step	NAME	step NOTES	PARAMS	KV	MA/H	init EFDt	scans Mode	sec EXP	sec COOL	init BIAS	max GX	TEST	min	max	LIM1	LIM2	LIM3	LIM4	data item	
01	WARMUP 60KV PULSE	PULSE KV WARMUP	136	60.	100	87.6	3.2	0.000	0.000	0.00	0.00	0	0.000	0.000	7.000	0.000	0.000	0.000	0	01
02	WARMUP 80KV PULSE	PULSE KV WARMUP	136	80.	100	86.8	3.2	0.000	0.000	0.00	0.00	0	0.000	0.000	7.000	0.000	0.000	0.000	0	02
03	WARMUP 100KV PULSE	PULSE KV WARMUP	136	100	100	86.4	3.2	0.000	0.000	0.00	0.00	0	0.000	0.000	7.000	0.000	0.000	0.000	0	03
04	WARMUP 120KV PULSE	PULSE KV WARMUP	136	120	100	86.1	3.2	0.000	0.000	0.00	0.00	0	0.000	0.000	7.000	0.000	0.000	0.000	0	04
05	WARMUP 140KV PULSE	PULSE KV WARMUP	136	140	100	85.8	3.2	0.000	0.000	0.00	0.00	0	0.000	0.000	7.000	0.000	0.000	0.000	0	05
06	lg spot WIDTH 120/300	mav=1.3mm, max=1.7mm	32	120	300	97.0	3.2	0.000	1000	0.00	0.00	330	1.300	1.70	0.000	0.000	0.000	0.000	1	06
07	lg spot LENGTH 120/300	mav=1.4mm, max=1.8mm	33554464	120	300	0.00	3.2	0.000	1000	0.00	0.00	16	1.400	1.800	0.000	0.000	1.100	0.000	2	07
08	CUTOFF 80KV 300 MA	2600V max, OFF =1.0 MA	32	80.	300	98.0	3.0	0.000	1000	0.00	3000	32	2000.	2600.	0.000	0.000	1.100	0.000	3	08
09	CUTOFF 100KV 300 MA	3200V max, OFF =1.0 MA	32	100	300	97.0	3.1	0.000	1000	0.00	3600	32	2600.	3200.	0.000	0.000	1.100	0.000	4	09
10	CUTOFF 120KV 300MA	3800V max, OFF =1.0 MA	32	120	300	96.5	3.2	0.000	1000	0.00	4200	32	3200.	3800.	0.000	0.000	1.100	0.000	5	10
11	CUTOFF 140KV 300MA	4400V max, OFF =1.0 MA	32	140	300	95.9	3.3	0.000	1000	0.00	4800	32	3800.	4400.	0.000	0.000	1.200	0.000	6	11
12	Gs for 0.7mm, 80KV 100MA	adj BIAS for 0.7mm WIDTH	288	80.	100	89.5	7.0	0.000	1000	300	600	202	0.680	0.720	0.710	0.000	0.690	0.000	7	12
13	+DEFLECT 80KV 100MA	meas Defl +0.46mm min	33620256	80.	100	0.00	7.0	0.000	1000	300	1200	132	0.460	666.0	0.710	0.000	0.690	0.000	25	13
14	-DEFLECT 80KV 100MA	meas Defl -0.46mm (min)	33751328	80.	100	0.00	7.0	0.000	1000	300	1200	132	-666.	-0.46	0.710	0.000	0.690	0.000	29	14
15	Gs for .7mm, 100KV 100MA	adj BIAS for 0.7mm WIDTH	288	100	100	89.0	3.0	0.000	1000	360	600	202	0.680	0.720	0.710	0.000	0.690	0.000	10	15
16	+DEFLECT 100KV 100MA	meas Defl +0.46mm min	33620256	100	100	0.00	3.0	0.000	1000	360	1200	132	0.460	666.0	0.710	0.000	0.690	0.000	33	16
17	-DEFLECT 100KV 100MA	meas Defl -0.46mm (min)	33751328	100	100	0.00	3.0	0.000	1000	360	1200	132	-666.	-0.46	0.710	0.000	0.690	0.000	37	17
18	Gs for 0.7mm, 120KV100MA	adj BIAS for 0.7mm WIDTH	288	120	100	88.7	3.1	0.000	1000	430	700	202	0.680	0.720	0.710	0.000	0.690	0.000	13	18
19	+DEFLECT 120KV 100MA	meas Defl +0.46mm min	33620256	120	100	0.00	3.1	0.000	1000	430	1600	132	0.460	666.0	0.710	0.000	0.690	0.000	41	19
20	-DEFLECT 120KV 100MA	meas Defl -0.46mm (min)	33751328	120	100	0.00	3.1	0.000	1000	430	1600	132	-666.	-0.46	0.710	0.000	0.690	0.000	45	20
21	Gs for 0.7mm, 140KV100MA	adj BIAS for 0.7mm WIDTH	288	140	100	89.0	3.1	0.000	1000	520	800	202	0.680	0.720	0.710	0.000	0.690	0.000	19	21
22	+DEFLECT 140KV 100MA	meas Defl +0.46mm min	33620256	140	100	0.00	3.1	0.000	1000	520	1600	132	0.460	666.0	0.710	0.000	0.690	0.000	57	22
23	-DEFLECT 140KV 100MA	meas Defl -0.46mm (min)	33751328	140	100	0.00	3.1	0.000	1000	520	1600	132	-666.	-0.46	0.710	0.000	0.690	0.000	61	23
24	Gs for 0.7mm, 120KV400MA	adj BIAS for 0.7mm WIDTH	288	120	400	105.	3.3	0.000	1000	500	800	202	0.680	0.720	0.710	0.000	0.690	0.000	16	24
25	+DEFLECT 120KV 400MA	meas Defl +0.46mm min	33620256	120	400	0.00	3.3	0.000	1000	500	1600	132	0.460	666.0	0.710	0.000	0.690	0.000	49	25
26	-DEFLECT 120KV 400MA	meas Defl -0.46mm (min)	33751328	120	400	0.00	3.3	0.000	1000	500	1600	132	-666.	-0.46	0.710	0.000	0.690	0.000	53	26
27	Gs for 0.7mm, 140KV400MA	adj BIAS for 0.7mm WIDTH	288	140	400	103.	3.3	0.000	1000	510	800	202	0.680	0.720	0.710	0.000	0.690	0.000	22	27
28	+DEFLECT 140KV 400MA	meas Defl +0.46mm min	33620256	140	400	0.00	3.3	0.000	1000	510	2000	132	0.460	666.0	0.710	0.000	0.690	0.000	66	28
29	-DEFLECT 140KV 400MA	meas Defl -0.46mm (min)	33751328	140	400	0.00	3.3	0.000	1000	510	1600	132	-666.	-0.46	0.710	0.000	0.690	0.000	69	29
30	.....	.....	0	0.0	0.0	0.00	0.0	0.000	0.000	0.00	0.00	0	0.000	0.000	0.000	0.000	0.000	0.000	0	30

Set first and last STEP (optional): → 

SEL SCHED automatically presets, change AR

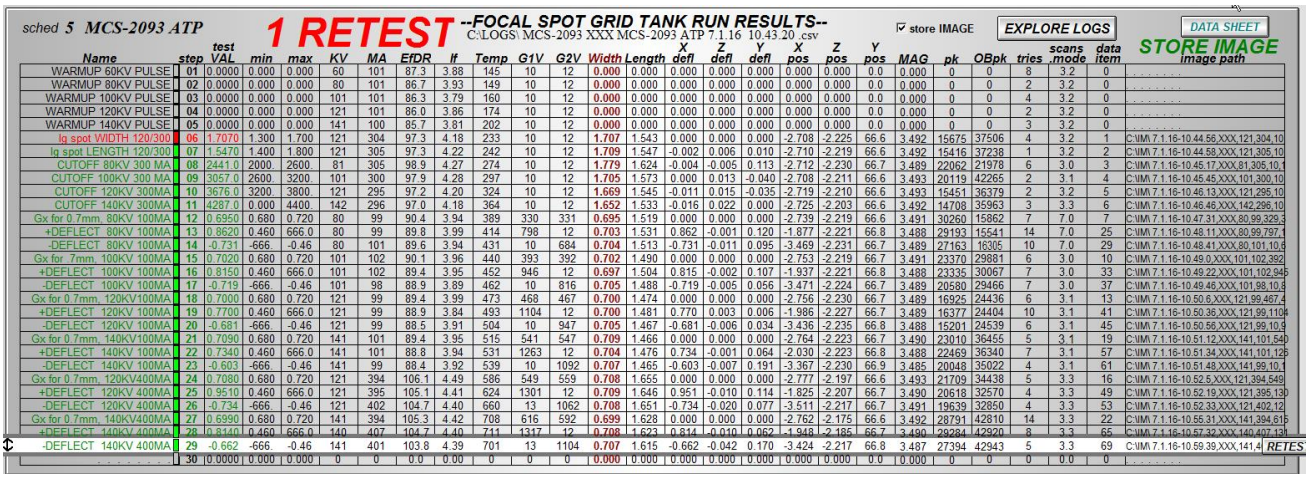
Initiate RUN: → 

starts at ***first*** step and proceeds through ***last*** step

Initiate RESET: → RESET F12 terminates Run AR (or ***F12***)

(MAIN* screen)** ***--READINGS-- displays current readings

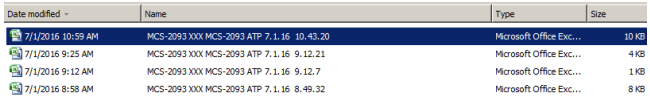
Set (*Temp*): → set 666 changes the current target ***TEMP***erature AR

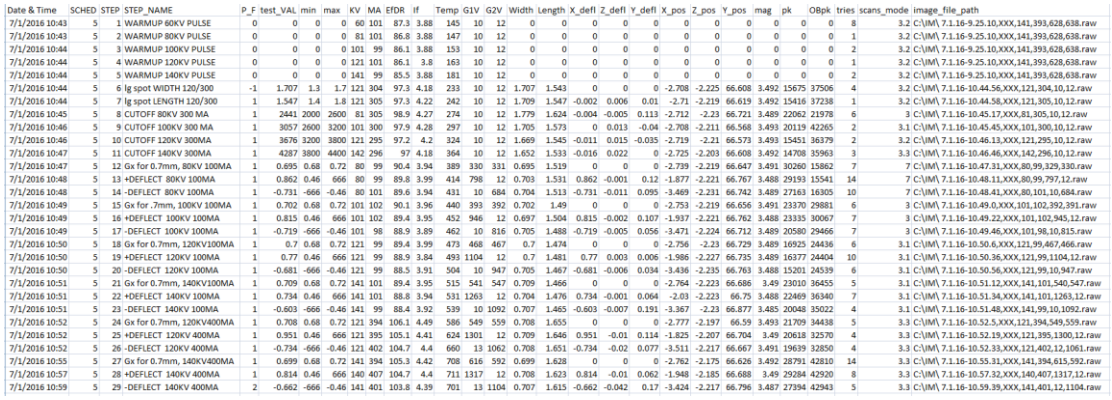


(MAIN* screen)** ***--FOCAL SPOT GRID TANK RUN RESULTS--

Store IMAGE: → ☑ store IMAGE controls focal spot image storage

***EXPLORE LOGS*:** EXPLORE LOGS → Alt-Tab to →

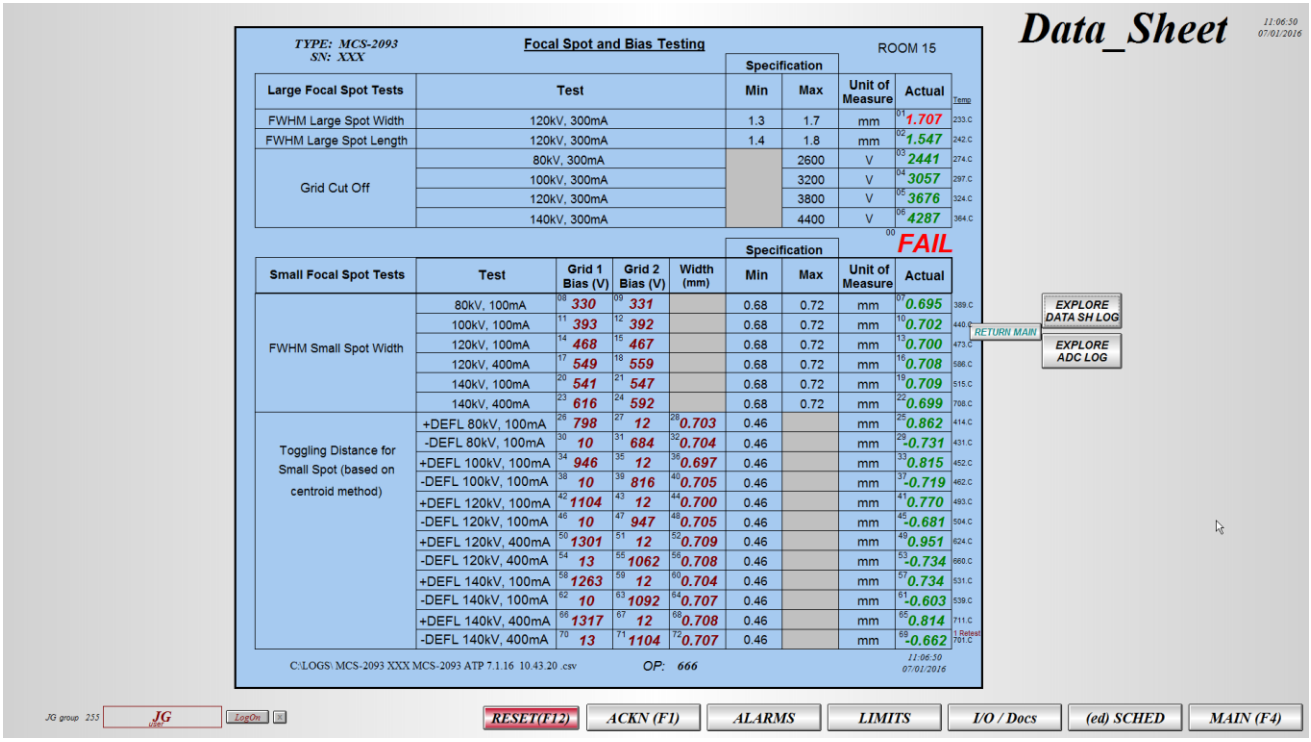




Date & Time	SCHED	STEP	STEP_NAME	P_F	test_VAL	min	max	KV	MA	EfDR	If	Temp	G1V	G2V	Width	Length	X_defl	Z_defl	Y_defl	X_pos	Z_pos	Y_pos	mag	pk	OBpk	tries	scans_mode	image_file_path
7/1/2016 10:43	5	1	WARMUP 60KV PULSE	0	0	0	0	60	101	87.3	3.88	145	10	12	0	0	0	0	0	0	0	0	0	0	0	8	3.2	C:\IM\ 7.1.16-9.25.10,XXX,141,393,628,638.raw
7/1/2016 10:43	5	2	WARMUP 80KV PULSE	0	0	0	0	81	101	86.8	3.88	147	10	12	0	0	0	0	0	0	0	0	0	0	0	1	3.2	C:\IM\ 7.1.16-9.25.10,XXX,141,393,628,638.raw
7/1/2016 10:44	5	3	WARMUP 100KV PULSE	0	0	0	0	101	99	86.1	3.88	153	10	12	0	0	0	0	0	0	0	0	0	0	0	2	3.2	C:\IM\ 7.1.16-9.25.10,XXX,141,393,628,638.raw
7/1/2016 10:44	5	4	WARMUP 120KV PULSE	0	0	0	0	121	101	86.1	3.8	163	10	12	0	0	0	0	0	0	0	0	0	0	0	1	3.2	C:\IM\ 7.1.16-9.25.10,XXX,141,393,628,638.raw
7/1/2016 10:44	5	5	WARMUP 140KV PULSE	0	0	0	0	141	99	85.5	3.88	181	10	12	0	0	0	0	0	0	0	0	0	0	0	2	3.2	C:\IM\ 7.1.16-9.25.10,XXX,141,393,628,638.raw
7/1/2016 10:44	5	6	lg spot WIDTH 120/300	-1	1.707	1.3	1.7	121	304	97.3	4.18	233	10	12	1.707	1.543	0	0	0	-2.708	-2.225	66.608	3.492	15675	37506	4	3.2	C:\IM\ 7.1.16-10.44.56,XXX,121,304,10,12.raw
7/1/2016 10:44	5	7	lg spot LENGTH 120/300	1	1.547	1.4	1.8	121	305	97.3	4.22	242	10	12	1.709	1.547	-0.002	0.006	0.01	-2.71	-2.219	66.619	3.492	15416	37238	1	3.2	C:\IM\ 7.1.16-10.44.58,XXX,121,305,10,12.raw
7/1/2016 10:45	5	8	CUTOFF 80KV 300 MA	1	2441	2000	2600	81	305	98.9	4.27	274	10	12	1.779	1.624	-0.004	-0.005	0.113	-2.712	-2.23	66.721	3.489	22062	21978	6	3	C:\IM\ 7.1.16-10.45.17,XXX,81,305,10,12.raw
7/1/2016 10:46	5	9	CUTOFF 100KV 300 MA	1	3057	2600	3200	101	300	97.9	4.28	297	10	12	1.705	1.573	0	0.013	-0.04	-2.708	-2.211	66.568	3.493	20119	42265	2	3.1	C:\IM\ 7.1.16-10.45.45,XXX,101,300,10,12.raw
7/1/2016 10:46	5	10	CUTOFF 120KV 300MA	1	3676	3200	3800	121	295	97.2	4.2	324	10	12	1.669	1.545	-0.011	0.015	-0.035	-2.719	-2.21	66.573	3.493	15451	36379	2	3.2	C:\IM\ 7.1.16-10.46.13,XXX,121,295,10,12.raw
7/1/2016 10:47	5	11	CUTOFF 140KV 300MA	1	4287	3800	4400	142	296	97	4.18	364	10	12	1.652	1.533	-0.016	0.022	0	-2.725	-2.203	66.608	3.492	14708	35963	3	3.3	C:\IM\ 7.1.16-10.46.46,XXX,142,296,10,12.raw
7/1/2016 10:47	5	12	Gx for 0.7mm, 80KV 100MA	1	0.695	0.68	0.72	80	99	90.4	3.94	389	330	331	0.695	1.519	0	0	0	-2.739	-2.219	66.647	3.491	30260	15862	7	7	C:\IM\ 7.1.16-10.47.31,XXX,80,99,329,330.raw
7/1/2016 10:48	5	13	+DEFLECT 80KV 100MA	1	0.862	0.46	666	80	99	89.8	3.99	414	798	12	0.703	1.531	0.862	-0.001	0.12	-1.877	-2.221	66.767	3.488	29193	15541	14	7	C:\IM\ 7.1.16-10.48.11,XXX,80,99,797,12.raw
7/1/2016 10:48	5	14	-DEFLECT 80KV 100MA	1	-0.731	-666	-0.46	80	101	89.6	3.94	431	10	684	0.704	1.513	-0.731	-0.011	0.095	-3.469	-2.231	66.742	3.489	27163	16305	10	7	C:\IM\ 7.1.16-10.48.41,XXX,80,101,10,684.raw
7/1/2016 10:49	5	15	Gx for .7mm, 100KV 100MA	1	0.702	0.68	0.72	101	102	90.1	3.96	440	393	392	0.702	1.49	0	0	0	-2.753	-2.219	66.656	3.491	23370	29881	6	3	C:\IM\ 7.1.16-10.49.0,XXX,101,102,392,391.raw
7/1/2016 10:49	5	16	+DEFLECT 100KV 100MA	1	0.815	0.46	666	101	102	89.4	3.95	452	946	12	0.697	1.504	0.815	-0.002	0.107	-1.937	-2.221	66.762	3.488	23335	30067	7	3	C:\IM\ 7.1.16-10.49.22,XXX,101,102,945,12.raw
7/1/2016 10:49	5	17	-DEFLECT 100KV 100MA	1	-0.719	-666	-0.46	101	98	88.9	3.89	462	10	816	0.705	1.488	-0.719	-0.005	0.056	-3.471	-2.224	66.712	3.489	20580	29466	7	3	C:\IM\ 7.1.16-10.49.46,XXX,101,98,10,815.raw
7/1/2016 10:50	5	18	Gx for 0.7mm, 120KV100MA	1	0.7	0.68	0.72	121	99	89.4	3.99	473	468	467	0.7	1.474	0	0	0	-2.756	-2.23	66.729	3.489	16925	24436	6	3.1	C:\IM\ 7.1.16-10.50.6,XXX,121,99,467,466.raw
7/1/2016 10:50	5	19	+DEFLECT 120KV 100MA	1	0.77	0.46	666	121	99	88.9	3.84	493	1104	12	0.7	1.481	0.77	0.003	0.006	-1.986	-2.227	66.735	3.489	16377	24404	10	3.1	C:\IM\ 7.1.16-10.50.36,XXX,121,99,1104,12.raw
7/1/2016 10:50	5	20	-DEFLECT 120KV 100MA	1	-0.681	-666	-0.46	121	99	88.5	3.91	504	10	947	0.705	1.467	-0.681	-0.006	0.034	-3.436	-2.235	66.763	3.488	15201	24539	6	3.1	C:\IM\ 7.1.16-10.50.56,XXX,121,99,10,947.raw
7/1/2016 10:51	5	21	Gx for 0.7mm, 140KV100MA	1	0.709	0.68	0.72	141	101	89.4	3.95	515	541	547	0.709	1.466	0	0	0	-2.764	-2.223	66.686	3.49	23010	36455	5	3.1	C:\IM\ 7.1.16-10.51.12,XXX,141,101,540,547.raw
7/1/2016 10:51	5	22	+DEFLECT 140KV 100MA	1	0.734	0.46	666	141	101	88.8	3.94	531	1263	12	0.704	1.476	0.734	-0.001	0.064	-2.03	-2.223	66.75	3.488	22469	36340	7	3.1	C:\IM\ 7.1.16-10.51.34,XXX,141,101,1263,12.raw
7/1/2016 10:51	5	23	-DEFLECT 140KV 100MA	1	-0.603	-666	-0.46	141	99	88.4	3.92	539	10	1092	0.707	1.465	-0.603	-0.007	0.191	-3.367	-2.23	66.877	3.485	20048	35022	4	3.1	C:\IM\ 7.1.16-10.51.48,XXX,141,99,10,1092.raw
7/1/2016 10:52	5	24	Gx for 0.7mm, 120KV400MA	1	0.708	0.68	0.72	121	394	106.1	4.49	586	549	559	0.708	1.655	0	0	0	-2.777	-2.197	66.59	3.493	21709	34438	5	3.3	C:\IM\ 7.1.16-10.52.5,XXX,121,394,549,559.raw
7/1/2016 10:52	5	25	+DEFLECT 120KV 400MA	1	0.951	0.46	666	121	395	105.1	4.41	624	1301	12	0.709	1.646	0.951	-0.01	0.114	-1.825	-2.207	66.704	3.49	20618	32570	4	3.3	C:\IM\ 7.1.16-10.52.19,XXX,121,395,1300,12.raw
7/1/2016 10:52	5	26	-DEFLECT 120KV 400MA	1	-0.734	-666	-0.46	121	402	104.7	4.4	660	13	1062	0.708	1.651	-0.734	-0.02	0.077	-3.511	-2.217	66.667	3.491	19639	32850	4	3.3	C:\IM\ 7.1.16-10.52.33,XXX,121,402,12,1061.raw
7/1/2016 10:55	5	27	Gx for 0.7mm, 140KV400MA	1	0.699	0.68	0.72	141	394	105.3	4.42	708	616	592	0.699	1.628	0	0	0	-2.762	-2.175	66.626	3.492	28791	42810	14	3.3	C:\IM\ 7.1.16-10.55.31,XXX,141,394,615,592.raw
7/1/2016 10:57	5	28	+DEFLECT 140KV 400MA	1	0.814	0.46	666	140	407	104.7	4.4	711	1317	12	0.708	1.623	0.814	-0.01	0.062	-1.948	-2.185	66.688	3.49	29284	42920	8	3.3	C:\IM\ 7.1.16-10.57.32,XXX,140,407,1317,12.raw
7/1/2016 10:59	5	29	-DEFLECT 140KV 400MA	2	-0.662	-666	-0.46	141	401	103.8	4.39	701	13	1104	0.707	1.615	-0.662	-0.042	0.17	-3.424	-2.217	66.796	3.487	27394	42943	5	3.3	C:\IM\ 7.1.16-10.59.39,XXX,141,401,12,1104.raw

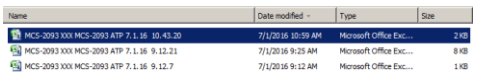
→

***csv GRID TANK RUN RESULTS* LOG**



DATA_SHEET SCREEN, accessed from ***MAIN*** screen → DATA SHEET

EXPLORE DATA SH LOG: EXPLORE DATA SH LOG →Alt-Tab to →

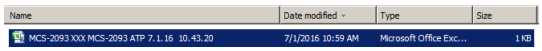


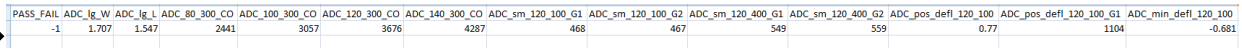
DATA[0]	DATA[1]	DATA[2]	DATA[3]	DATA[4]	DATA[5]	DATA[6]	DATA[7]	DATA[8]	DATA[9]	DATA[10]	DATA[11]	DATA[12]	DATA[13]	DATA[14]	DATA[15]	DATA[16]
→ -1	1.707	1.547	2441	3057	3676	4287	0.695	330	331	0.702	393	392	0.7	468	467	0.708

Log contains Pass/Fail [0] plus [01] to [72] data items from data sheet above

ECO # - Description	Revision Date
ECO #– Establish	08/16/2016

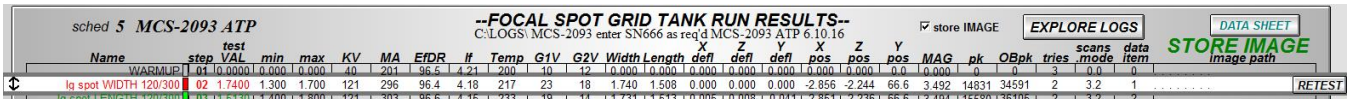
EXPLORE ADC LOG: 

→Alt-Tab to  → 

→ 

PASS_FAIL	ADC_lg_W	ADC_lg_L	ADC_80_300_CO	ADC_100_300_CO	ADC_120_300_CO	ADC_140_300_CO	ADC_sm_120_100_G1	ADC_sm_120_100_G2	ADC_sm_120_400_G1	ADC_sm_120_400_G2	ADC_pos_defl_120_100	ADC_pos_defl_120_100_G1	ADC_min_defl_120_100
-1	1.707	1.547	2441	3057	3676	4287	468	467	549	559	0.77	1104	-0.681

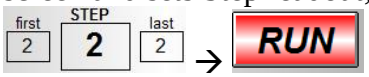
Automatic **D**ata **C**ollection log contains abbreviated data sheet log tracking 19 key items



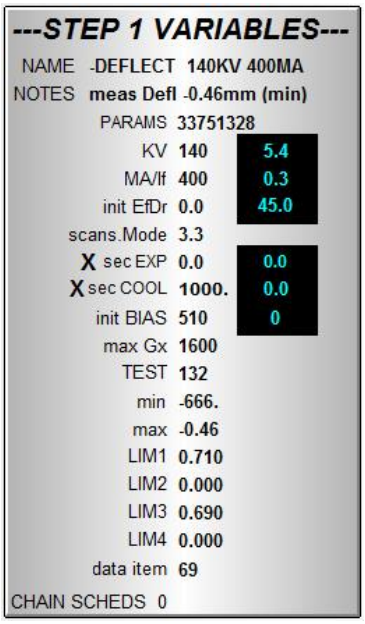
Name	step	test VAL	min	max	KV	MA	EfDR	If	Temp	G1V	G2V	Width	Length	X defl	Z defl	Y defl	X pos	Z pos	Y pos	MAG	pk	OBpk	tries	scans mode	data item
WARMUP	01	0.0000	0.000	0.000	40	201	96.5	4.21	200	10	12	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0	0.000	0	0	3	0.0	0
lg spot WIDTH 120/300	02	1.7400	1.300	1.700	121	296	96.4	4.18	217	23	18	1.740	1.508	0.000	0.000	0.000	-2.856	-2.244	66.6	3.492	14831	34591	2	3.2	1

***(MAIN* screen)** **Magnifier bar:** click and drag to desired step, also moves bar on 

screen and sets Step readout, Use to initiated ***RETEST*** of step(s). **RETEST:** 

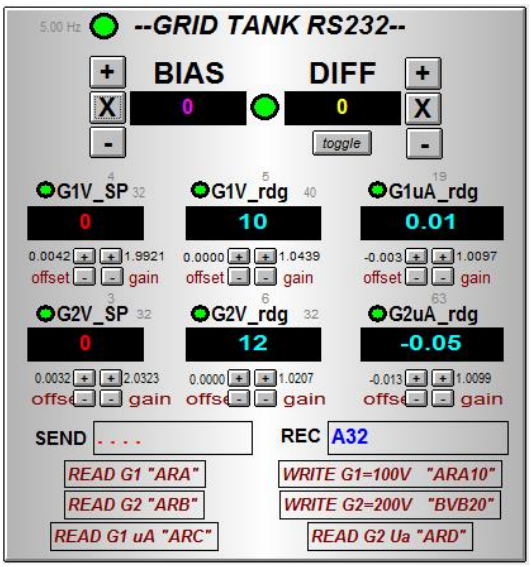
→ 

reRuns Step(s) indicated without zeroing other step test results.



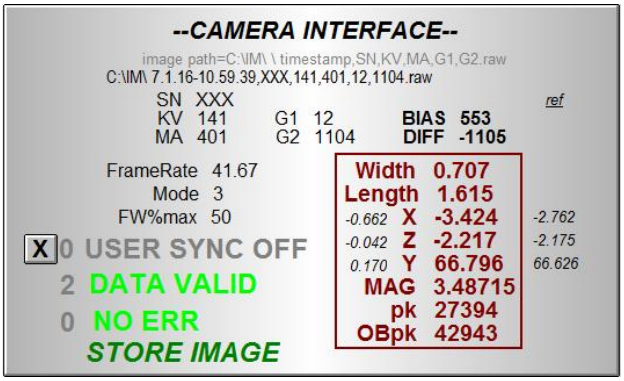
(MAIN* screen)** ***--STEP "X" VARIABLES--

Displays schedule current step variables. If security permits, variables may be changed to alter step behavior, but they do not alter the saved schedule. Click 32 bit coded numbers ***PARAMS*** and ***TEST*** to display presently active flags. X zeroes out ***sec EXP*** and ***sec COOL*** variables



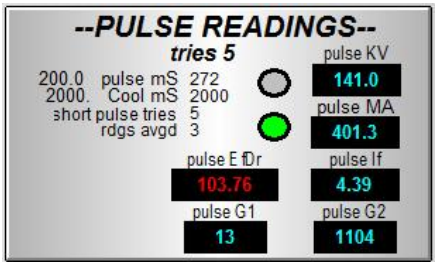
(MAIN* screen) *--GRID TANK RS232--

Displays status of Grid Tank G1 and G2 voltages.  indicates there is sufficient filament current (1.8A) to power the Grid Tank and that communications are functioning properly. If security permits, ***BIAS*** may be changed manually for Calibration or modified testing. ***DIFF***erential may also be set and  inverts ***DIFF***. Gains and offsets may be modified for analog signal calibration AR. ***G1V_rdg*** and ***G2V_rdg*** are calibrated signals. ***G1V_SP*** and ***G1V_SP*** are then adjusted so resulting voltage readouts match the setpoint values. Manual RS232 commands may be sent to test communication functions clicking  controls or manually entering 



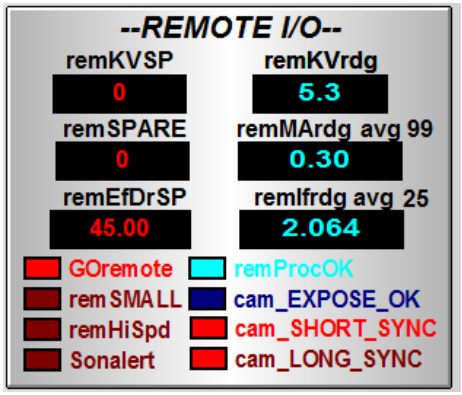
(MAIN* screen) *--CAMERA INTERFACE--

The ThinkNDO control and Labview Camera programs communicate via OPC server using variables in this box. These are display only with exception of ***USER SYNC*** and DATA commands which may be set to 0, 1, or 2 for debug purposes.



(MAIN* screen)** ***--PULSE READINGS--

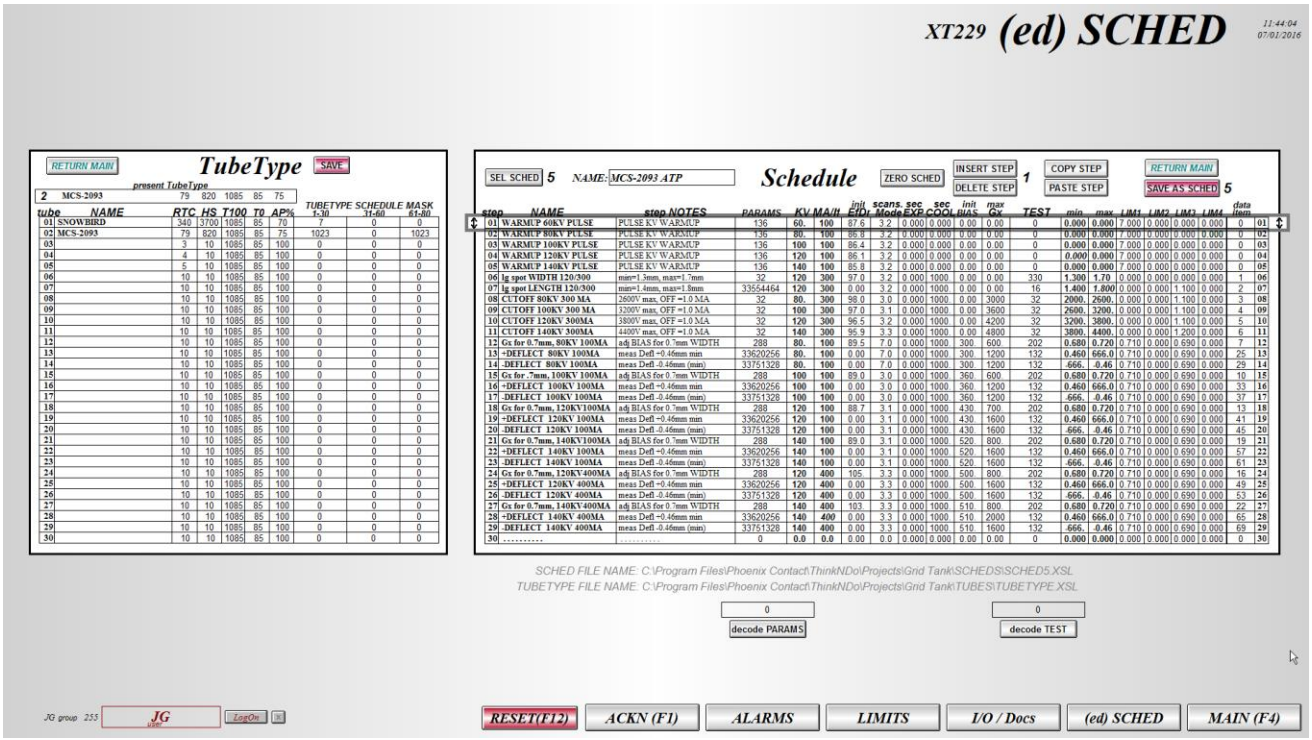
KV is pulsed to minimize tube heating. Red LED indicates KV being pulsed. Green LED indicates that last pulse KV and MA are within (2%) tolerance and Camera will process ***Width*** etc, next cycle.



(MAIN* screen)** ***--REMOTE I/O--

Status of HV Stn ***REM*** remote control interface signals. GOremote starts stator and turns on HV supply. (2) sync signals are diode ORed & drive flat panel ***USER SYNC*** DB9 connector.

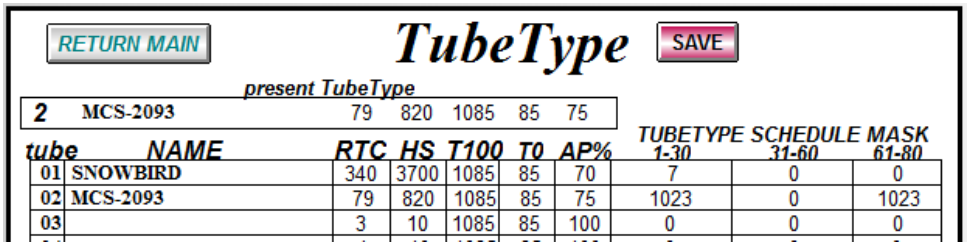
Rfcds



ITEM: ***(ed)SCHED*** **screen accessed from most screens →** *(ed) SCHED*

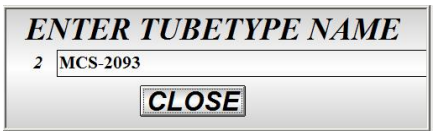
DESCRIPT: Edit 30 Tubetype Heat Integrator models and Schedule Run Masks. Edit individual schedule consisting of 30 steps, each with 19 entry variables.

USE:



(edSCHED* screen) EDIT *TubeType

Click on ***NAME*** →



and enter in box that pops up.

ECO # - Description	Revision Date
ECO #– Establish	08/16/2016

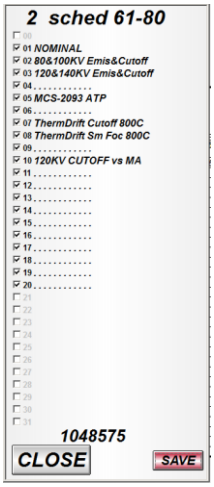
Double click and enter Heat Integrator constants AR →

RTC	HS	T100	T0	AP%
340	3700	1085	85	70
79	820	1085	85	75

Click Schedule Mask numbers

TUBETYPE SCHEDULE MASK 1-30	31-60	61-80
7	0	0
1073741823	1047552	1048575

and check allowed schedules on popup screen →



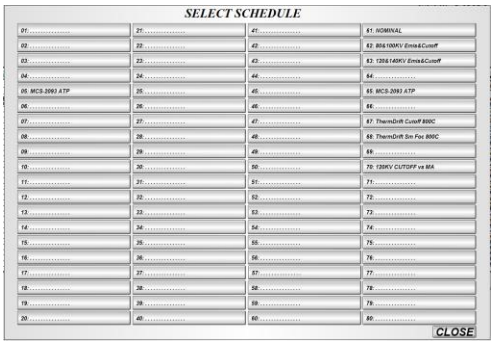
Save Tubetypes (RECIPE002) when done → SAVE

SEL SCHED 5 NAME: MCS-2093 ATP **Schedule** ZERO SCHED INSERT STEP 1 DELETE STEP COPY STEP PASTE STEP RETURN MAIN SAVE AS SCHED 5

step	NAME	step NOTES	PARAMS	KV	MA/H	init EfDr	scans. sec Mode	sec EXP	sec COOL	init BIAS	max Gx	TEST	min	max	LIM1	LIM2	LIM3	LIM4	data item	
01	WARMUP	GO TO TEMP=LIMITS[32]	130	40.	50.	82.0	0.0	1000.	0.000	0.00	0.00	0	0.000	0.000	0.000	0.000	0.000	0.000	0	01
02	lg spot WIDTH 120/300	min=1.3mm, max=1.7mm	32	120	300	97.0	3.2	0.000	1000.	0.00	0.00	74	1.300	1.700	0.000	0.000	0.000	0.000	1	02
03	lg spot LENGTH 120/300	min=1.4mm, max=1.8mm	33554464	120	300	0.00	3.2	0.000	1000.	0.00	0.00	16	1.400	1.800	0.000	0.000	1.100	0.000	2	03

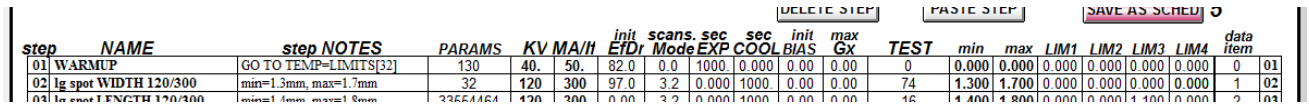
(SCHED screen) EDIT *Schedule*

Select schedule to edit → SEL SCHED →



→ 5

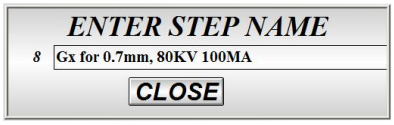
Edit FUNCTIONS allow flexibility. ***ZERO*** entire schedule, or ***INSERT*** blank step before step 1 or ***DELETE*** step 1. ***COPY*** 1 to step memory, or PASTE from memory into step 1. Remember to SAVE AS SCHED 5 when done, it's easy to lose work if another schedule is loaded from this screen or from ***MAIN***. There is only one common schedule memory on this system and it is used for both Edit and Run purposes.



step	NAME	step NOTES	PARAMS	KV	MA/H	init EFDr	scans. sec Mode	sec EXP	sec COOL	init BIAS	max Gx	TEST	min	max	LIM1	LIM2	LIM3	LIM4	data item	
01	WARMUP	GO TO TEMP=LIMITS[32]	130	40.	50.	82.0	0.0	1000.	0.000	0.00	0.00	0	0.000	0.000	0.000	0.000	0.000	0.000	0	01
02	lg spot WIDTH 120/300	min=1.3mm, max=1.7mm	32	120	300	97.0	3.2	0.000	1000.	0.00	0.00	74	1.300	1.700	0.000	0.000	0.000	0.000	1	02
03	lg spot LENGTH 120/300	min=1.4mm, max=1.8mm	33664464	120	300	0.00	3.2	0.000	1000	0.00	0.00	16	1.400	1.800	0.000	0.000	1.100	0.000	2	03

***(edSCHED* screen)** **NINETEEN STEP VARIABLES** completely define step operation (**below**)

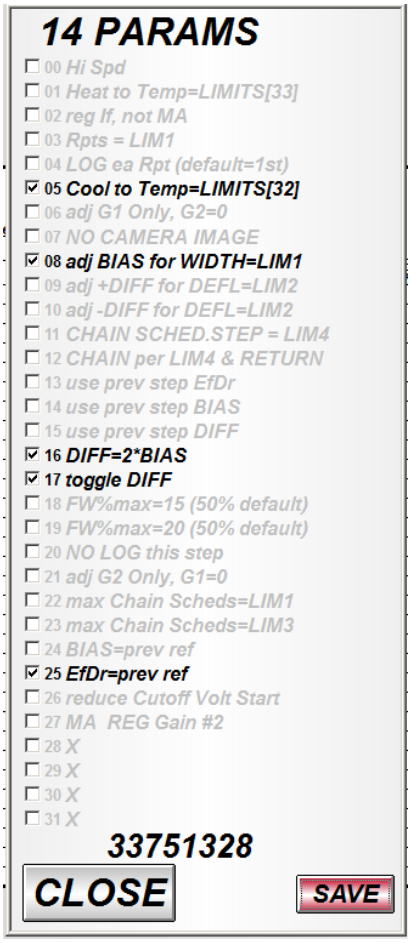
NAME: 08 Gx for 0.7mm, 80KV 100MA →



24 char displays in ***RUN RESULTS*** table as well as csv Data Log

step NOTES: adj BIAS for 0.7mm WIDTH →

24 char note, ref only



PARAMS: → 33751328 →

☑ 00 ***Hi Spd*** → 0 3 remHiSpd output to HV Stn *REM-19* is HI (+24V) during step

☑ 01 ***Heat to Temp=LIMITS[32]*** terminate step ***EXP***osure early if Temp reaches ***LIMITS***[32]

☑ 02 ***reg If, not MA*** adjust Rm15 Behlman ***EfDR*** to regulate I_f level (default = reg MA)

☑ 03 ***Rpts = LIM1*** Exposure/Cool sequence is repeated additional times set by ***LIM1*** value

☑ 04 ***LOG ea Rpt (default=1st)*** Data Log adds line for each step repeat instead of first time only

☑ 05 ***Cool to Temp=LIMITS[33]*** terminate step ***COOL*** early if ***Temp*** reaches ***LIMITS***[33]

☑ 06 ***adj G1 Only, G2=0*** for single gridded tubes with ***G2*** shorted to ***Com***

☑ 07 ***NO CAMERA IMAGE*** does not capture, process, or record camera image for this step

☑ 08 ***adj BIAS for WIDTH=LIM1*** increase ***BIAS*** from ***init BIAS*** until ***Width*** < ***LIM1***

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☑ 09 ***adj +DIFF for DEFL=LIM2*** increase ***DIFF*** (G1>G2) until ***X defl > LIM2***

☑ 10 ***adj -DIFF for DEFL=LIM2*** decrease ***DIFF*** (G1<G2) until ***X defl < LIM2***

☑ 11 ***CHAIN SCHED.STEP = LIM4*** go to sched.step → ***3.07=sched 3, step 7*** (DataLogs all)

☑ 12 ***CHAIN per LIM4 & RETURN*** go to ***sched.step=LIM4*** and return to next step this sched

☑ 13 ***use prev step EfDr*** use ***EfDr*** level from previous step for ***init EfDr*** (same If level)

☑ 14 ***use prev step BIAS*** use ***BIAS*** level from previous step for ***init BIAS***

☑ 15 ***use prev step DIFF*** use ***DIFF*** level from previous step (zero default)

☑ 16 ***DIFF=2*BIAS*** gives maximum possible +***X defl*** for a given ***BIAS***

☑ 17 ***toggle DIFF*** multiplies ***DIFF*** by -1 → ***-X defl***

☑ 18 ***FW%max=15 (50% default)*** calculate Width/Length at15% of peak, threshold value

☑ 19 ***FW%max=20 (50% default)*** calculate Width/Length at20% of peak, threshold value

☑ 20 ***NO LOG this step*** don't add line to ***Data Log*** this step, for lifetest, etc.

☑ 21 ***adj G2 Only, G1=0*** for single gridded tubes with ***G2*** shorted to ***Com***

☑ 22 ***max Chain Scheds=LIM1*** limit number of ***CHAIN SCHED.STEP*** "repeats"

☑ 23 ***max Chain Scheds=LIM3*** limit number of ***CHAIN SCHED.STEP*** "repeats"

☑ 24 ***BIAS=prev ref*** ***init BIAS*** is set to previously stored (***TEST00***) value

☑ 25 ***EfDr=prev ref*** ***init EfDr*** is set to previously stored (***TEST06***) value

☑ 26 ***reduce Cutoff Volt Start*** 25% less initial ***Gx*** turn on for lower volt grids (MCS-640)

☑ 27 ***MA REG Gain #2*** selects Gain in LIMITS[39] instead of LIMITS[18]

KV: exposure KV level, typically pulsed for 250 mS, but can be continuous

MA/If: ***EfDr*** is adjusted to obtain this ***MA*** or I_f (***PARAMS02***) level

init EfDr: ***EfDr*** is initially set to this level

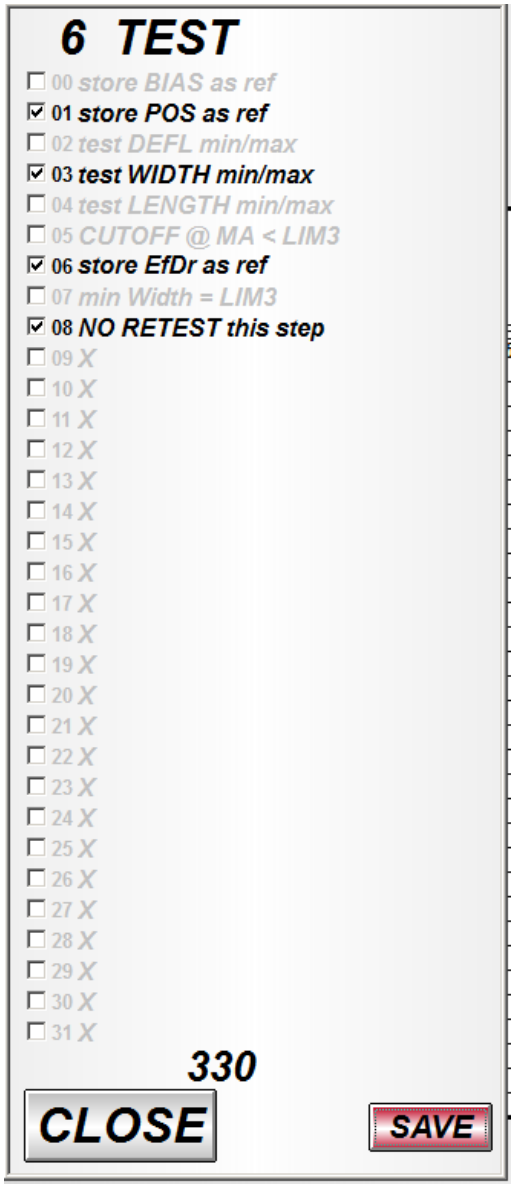
scans.Mode: sets camera frame rate and mode. Scans is # of 8 mS PLC scans. Mode controls camera charge amp capacitance. 0=.5pF, 1=1pF, 2=2pF, 3=3pF, 4=4pF. ***3.3 → 41.67Hz & 3pF***

sec EXP: max exposure time. **0.0 sets min KV pulse time,** about 250 mS to reduce tube heat

sec COOL: max cool time. **0.0 sets min cool time** about 2000 mS for faster testing

init BIAS: initial voltage which both ***G1*** and ***G2*** are set to

max Gx: maximum voltage level ***G1*** OR ***G2*** are clamped to during the step



TEST: → 330 →

☑ 00 ***store BIAS as ref*** saves ***BIAS*** level reached for recall by ***PARAMS24*** in later steps

☑ 01 ***store POS as ref*** stores X-Z-Y positions for reference in future step deflection tests

☑ 02 ***test DEFL min/max*** calculates ***DEFL***ection and compares to ***min*** and ***max*** variables

→

Name	step	test VAL	min	max
lg spot WIDTH 120/300	02	1.7260	1.300	1.700

☑ 03 ***test WIDTH min/max*** calculates ***Width*** and compares to ***min*** and ***max*** variables

☑ 04 ***test LENGTH min/max*** calculates ***Length*** and compares to ***min*** and ***max*** variables

☑ 05 ***CUTOFF @ MA < LIM3*** raise ***BIAS*** until ***MA*** < ***LIM3***, compare to ***min*** and ***max***

☑ 06 ***store EfDr as ref*** save ***EfDr*** level for recall by ***PARAMS25***

☑ 07 ***min Width = LIM3*** fails and retests if width too low in deflection test

☑ 08 ***NO RETEST this step*** defeats auto retest if large spot width fails, *one chance only*

min: minimum value used by ***TEST*** functions in determining Pass/Fail

max: maximum value used by ***TEST*** functions in determining Pass/Fail

LIM1, 2, 3,4: free variables assigned assorted functions by ***PARAMS*** and ***TEST***

data item: non-zero value assigns ***TEST*** result to data sheet item #1-72 for display and logging

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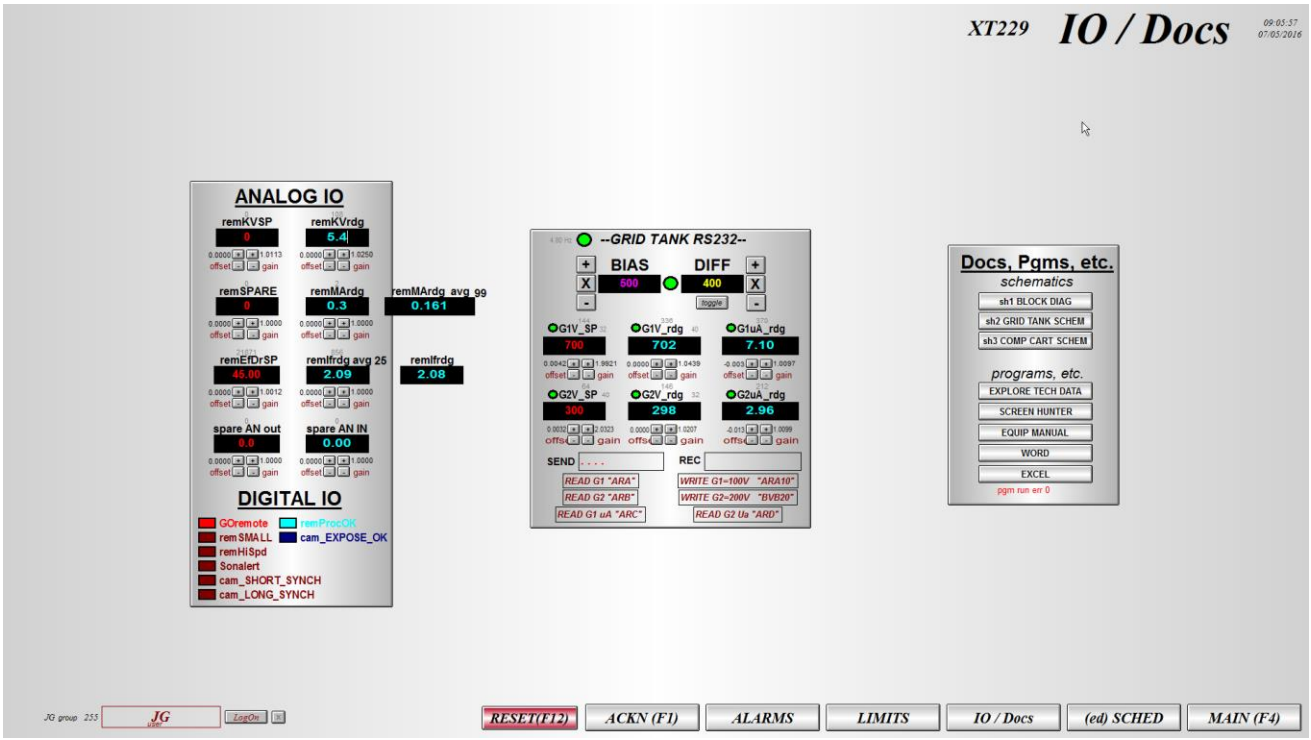
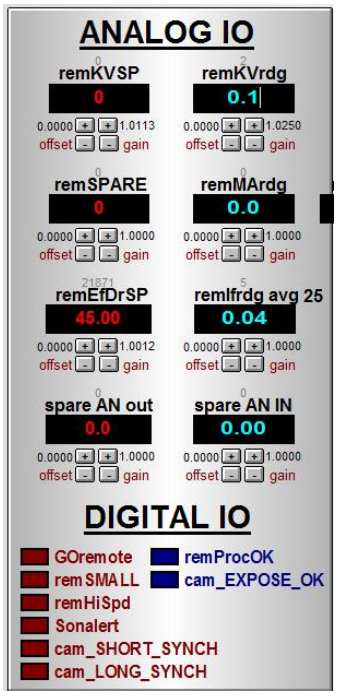


ITEM: ***I/O Docs*** **screen accessed from most screens →** ***I/O / Docs***

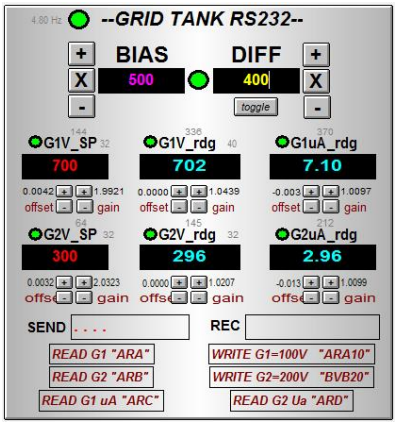
DESCRIPT: displays analog, digital, andRS232 Grid Tank IO, including Cal gains & offsets. Docs, Pgms, etc.



DETAILS: ***ANALOG & DIGITAL IO*:**

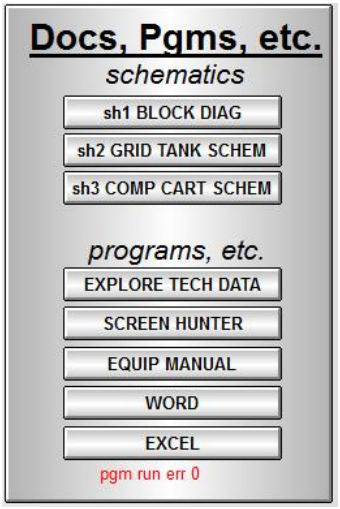
ANALOG IO: displays analog readings. Cal gains and offsets set linearity, red=Output, blu=Input.

DIGITAL IO: displays digital IO status. red=Output, blu=Input.

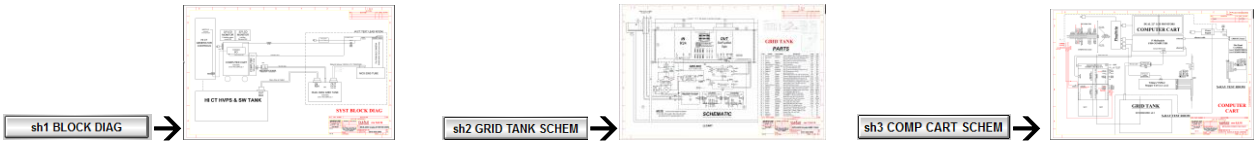


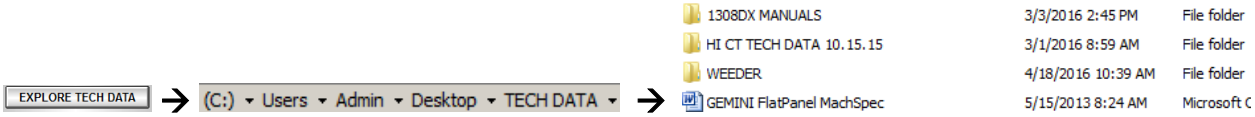
GRID TANK RS232*:** fiber-optic communications provides 150 KV isolation. Gain and offset Cal adjustments treat settings and readings as normal analog IO. Manual send/receive boxes allow testing communications. Tanks is powered by Behlman filament drive so make sure Behlman output switch is on.  Green indicates communications is OK. Arcs can cause light to become red. Try recycling Behlman power to restore green status. Manual setting of ***BIAS and ***DIFF*** grid

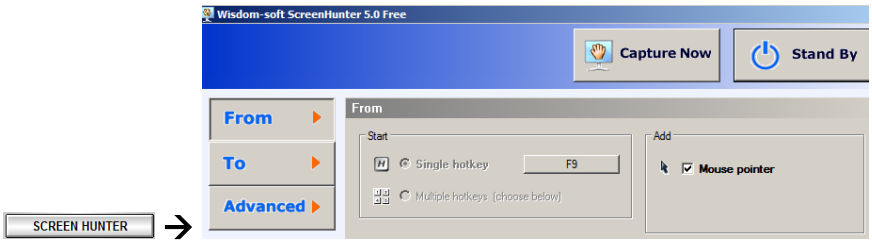
voltage settings is supported.



TDocs, Pgms, etc.*:** support documentation click button, use ***"Alt-Tab"







→ use F9 to capture screen shots

VARIAN medical systems	X-RAY PRODUCTS – PRODUCT DOCUMENTATION MCS-2093 AUTO GRID TEST EQUIPMENT MANUAL **Equip # XT229**		
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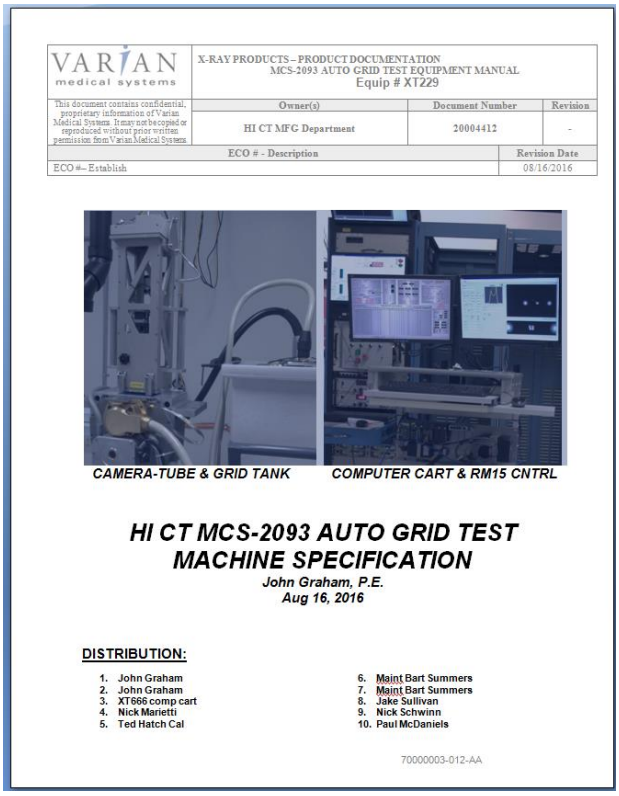
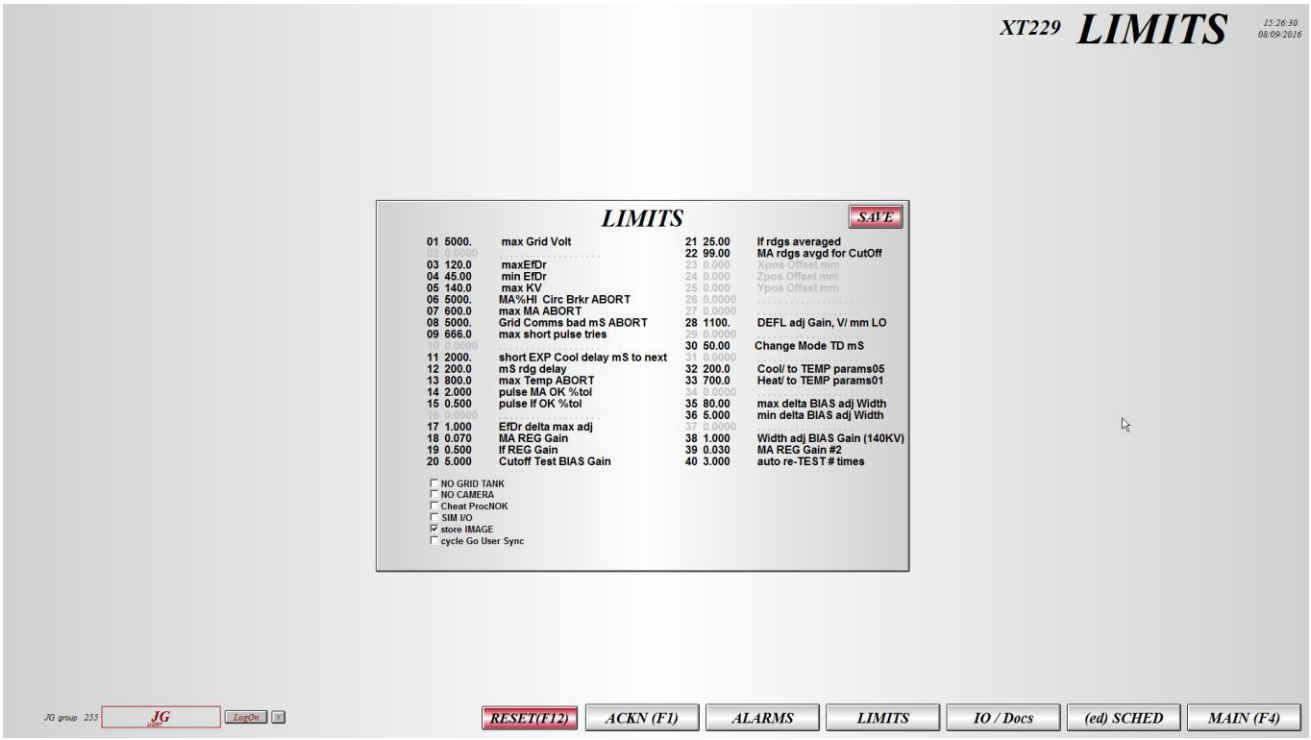


EQUIP MANUAL → opens this manual

WORD → opens blank Word document

EXCEL → opens blank Excel document



ITEM: ***LIMITS*** **screen accessed from most screens →** LIMITS **button**

DESCRIPT: global settings in retentive that apply to all tubetypes and schedules

USE: requires security level ≥ 200 to change. SAVE stores retentive memory

DETAILS: individual registers and checkboxes explained below:

01 5000. max Grid Volt: G1 and G2 clamped to this value
03 120.0 max EfDr: max Behlman filament drive voltage (HV Stn 15, powers Grid Tank)
04 45.00 min EfDr: min Behlman filament drive voltage (HV Stn 15, powers Grid Tank)
05 140.0 max KV: KV clamped to this value
06 30.00 MA%HI Circ Brkr ABORT: Run aborts if MA exceeds ***20%*** of schedule →Alarm06
07 600.0 max MA ABORT: Run aborts if MA exceeds ***600*** →Alarm06
08 5000.0 Grid Comms bad mS ABORT: Run aborts if Grid RS232 bad 5 sec →Alarm05
09 20.00 max short pulse tries: if exceeded in step, trips Alarm07 and Aborts Run

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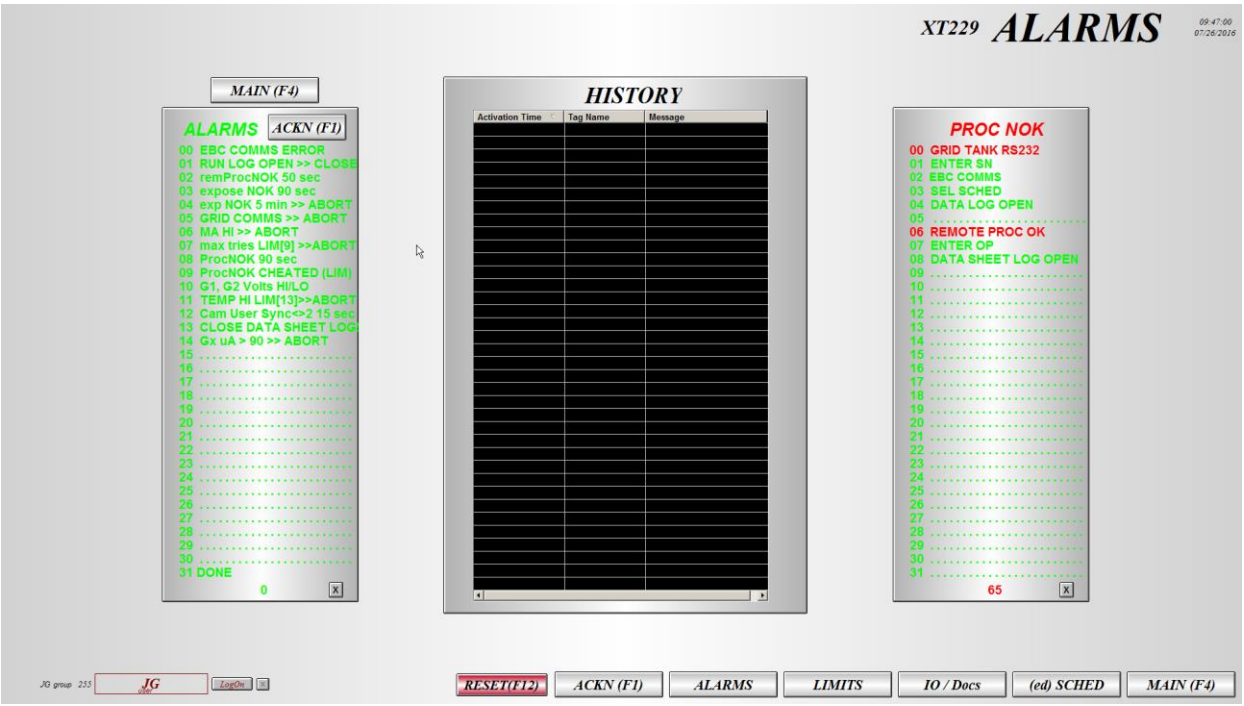
11 2000. Short EXP Cool delay mS to next: Pulse exposure cool time to next pulse (Ef adj time)
12 120.0 mS rdg delay: allows KV pulse to settle before reading KV and MA levels ≥3 times
13 800.0 max Temp: if exceeded → ***Alarm11***, ***Reset PB***, and ***Sleep*** modes shut off Grid Tank
14 2.000 pulse MA OK %tol: if "*reg MA*", ***MArdg*** tol to proceed or ±2 MA whichever smaller
15 0.500 pulse If OK %tol: if "*reg If*", ***Ifrdg*** tol for camera focal processing to proceed
17 1.000 EfDr delta max adj: largest EfDr adjustment permitted between exposures
18 0.070 MA REG Gain: gain setting for ***regMA*** calculations to adjust EfDr
19 0.500 If REG Gain: gain setting for ***regIf*** calculations to adjust EfDr
20 5.000 Cutoff Test Bias Gain: gain setting for ***Cutoff Test*** calculations to adjust ***BIAS***
21 25.00 If rdgs averaged: average ***Ifrdgs*** to filter out noise
22 99.00 MA rdgs averaged for CutOff: average ***MArdgs*** to filter out noise
23 0.000 Xpos Offset mm: subtract value from camera ***Xpos*** readings, to correct location
24 0.000 Zpos Offset mm: subtract value from camera ***Zpos*** readings, to correct location
25 0.000 Ypos Offset mm: subtract value from camera ***Ypos*** readings, to correct location
28 1100. DEFL adj Gain, V/mm LO: gain setting to increase ***DIFF*** to obtain spec deflection
30 50.00 Change Mode TD mS: TD when changing camera mode →***calc Hz MODE*** chart
32 200.0 Cool/to TEMP params05: terminate ***Cool*** early if this temp reached (see Params05)
33 700.0 Heat/to TEMP params01: terminate ***Exp***osure early if temp reached (see Params01)
35 80.00 max delta BIAS adj Width: clamp max ***BIAS*** increment to decrease ***Width***
36 5.000 min delta BIAS adj Width: clamp min ***BIAS*** increment to decrease ***Width***
38 1.000 Width adj BIAS Gain (140KV): gain setting for incrementing ***BIAS*** to decrease ***Width***
39 0.030 MA REG Gain #2: alternate gain setting for ***regMA*** calculations, see ***PARAMS[27]***
40 3.000 auto re-TEST # times: if ***Fail***, retest n times unless ***TEST08 NO RETEST this step***

☑ NO GRID TANK allows running w/o grid tank
☑ NO CAMERA allows running w/o camera
☑ Cheat ProcNOK clears ***ProcNOK*** to zero and turns on Alarm 09 ProcNOK CHEATED (LIM)
☑ SIM I/O KV-MA-If rdgs are displayed as schedule values → for development w/o HV Stn
☑ store IMAGE stores camera image unless ***Params07 NO CAMERA IMAGE*** is on
☑ cycle Go User Sync enables chart ***CHANGE MODE*** → **CYCLE GO USER SYNC EVERY 15 SEC IF <>2**



ITEM: ***ALARMS SCREEN***, accessed from most screens → ALARMS

DESCRIPT: Screen presents status and history of ***ALARM***, a 32 bit-coded integer. Also, status of ***PROC_NOK***, a 32 bit-coded integer which must be zero to enable HV.

USE: ACKN (F1) acknowledges alarm and silences sonalert. ***HISTORY*** logs alarms and operator ackn activity. ***PROC_NOK*** indicates conditions that must be corrected before HV exposures may continue. X clears each integer, but if persisting condition will reoccur.

DETAILS: ***ALARMS*** is detailed first, then ***PROC_NOK***

ALARMS:

00 EBC COMMS ERROR: chart ***WATCHDOG*** watches I-0, ***EBC_ERROR*** and sounds alarm if ON. Also turns ON O-0 ***CLEAR_EBC_ERROR***. Hopefully alarm clears automatically

01 RUN LOG OPEN >> CLOSE: ***ALARMS*** chart sets if N-85 ***RUN_LOG_ERR***=1011

02 remProcNOK 50 sec: chart ***TIME*** checks ***remProcOK*** I-1 and alarms if HV Stn is NOK

03 expose NOK 90 sec: chart ***TIME*** checks ***XPOSE_TMR*** T-28 and alarms if ***cam_USER_SYNC*** N-133<>2 hangs exposure (chart ***RUN STEP***)

04 expose NOK 5 min >> ABORT: chart ***TIME*** checks ***XPOSE_TMR*** T-28, aborts Run, and alarms if ***cam_USER_SYNC*** N-133 <>2 hangs exposure (chart ***RUN STEP***) for 300 sec

05 GRID COMMS >> ABORT: chart ***WATCH GRID COMMS*** checks f158 ***GridTank_RS232_OK*** F-158, aborts Run, and alarms if NOK >10 sec

06 MA HI >> ABORT: chart ***MA HI CIRC BRKR*** watches FP66 ***remMArdg*** and aborts Run if higher than LIMITS[6 or 7]

07 max tries LIM[09] >>ABORT: subchart ***RUN STEP*** counts ***shortpulse_tries*** N-121 and aborts Run if > 09 666.0 max short pulse tries

08 ProcNOK 90 sec: chart ***PROC_NOK*** alerts operator if ***PROC_NOK*** N-80 >0 90 sec (Run)

09 ProcNOK CHEATED (LIM): chart ***PROC NOK*** watches F-215 ☑ Cheat ProcNOK (***LIMITS***) and follows state

10 G1, G2 Volts HI/LO: chart ***G1 G2*** alarms if ***G1V_rdg*** FP-44 or ***G2V_rdg*** FP-45 deviate 100V from ***G1V_SP*** FP-42 or ***G2V_SP*** FP-43, 10 sec

11 TEMP HI LIM[13]>>ABORT: chart ***HEAT_INT*** aborts Run if ***Temp_rdg*** FP-54 exceeds ***LIMITS***[13] ARR-99

12 Cam User Sync<>2 15 sec: chart ***CHANGE MODE*** monitors ***cam_USER_SYNC*** N-133 status (0=OFF, 1=GO USER SYNC, 2=USER SYNC) → something wrong with Camera program if chart enabled by ☑ cycle Go User Sync (Limits)

13 CLOSE DATA SHEET LOG!: ***ALARMS*** chart sets if N-159 ***DSLOG_ERR***=1011

14 Gx Ua > 90 >> ABORT: ***ALARMS*** chart alarms & ABORTS if G1uA_rdg or G2uA_rdg >90

31 DONE: subchart ***DONE*** signals Run complete

PROC OK:

00 GRID TANK RS232: ***GridTank_RS232_OK*** F-158, Tank Communications is down →make sure Behlman output is on and tube filament current is > 2A

01 ENTER SN: ***SN_NAME*** STR-10 =”enter SN” → enter serial number

02 EBC COMMS: ***ALARMS***[0] ARR-98 is ON → IO rack communications is down

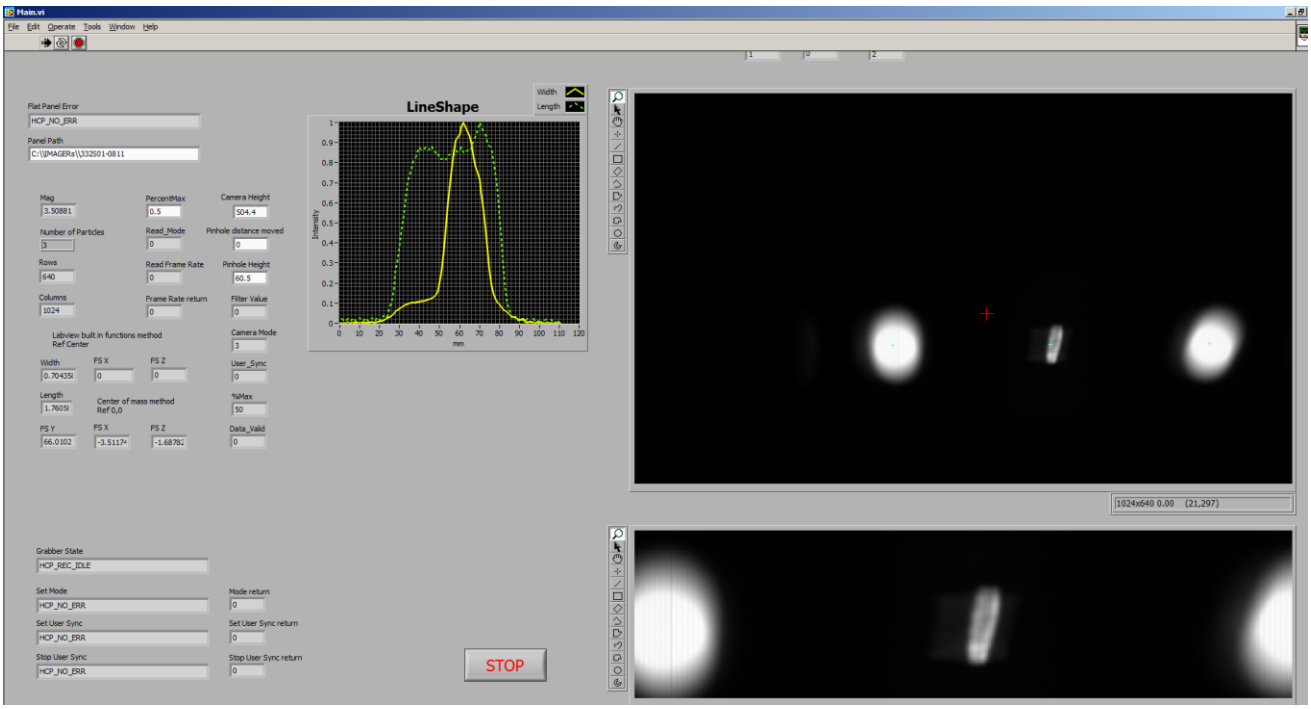
03 SEL SCHED: ***SCHED_NUMBER*** N-64 = 0

04 DATA LOG OPEN: ***ALARMS***[1] ARR-98 is ON → close this Run Data Log

06 REMOTE PROC OK: ***remProcOK*** I-1 is OFF → HV Station stator, interlocks, etc NOK

07 ENTER OP: ***OP_NAME*** STR-10 =”enter OP” → enter Operator Number/name

08 DATA SHEET LOG OPEN: ***ALARMS***[13] ARR-98 is ON → close this Run Data Sheet Log



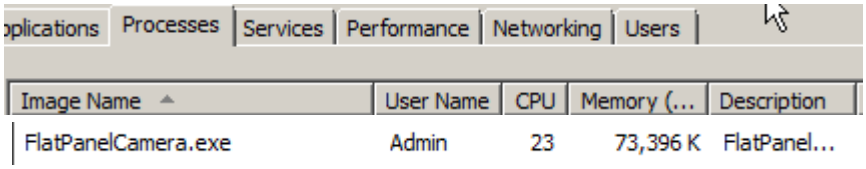
00

ITEM: ***LABVIEW Main.vi***, flat panel camera control program

DESCRIPT: custom application program aquires pin hole camera image when F-244 ***cam_IMAGE_ READ*** turns on and analyzes the image when N-136 ***cam_DATA***=1. ***Width***, ***Length***, ***X***, ***Z***, and ***Y*** positions are calculated together with ***MAG*** and peak image intensities. ThinkNDo OPC server communicates these values to the main program control program which calls for a specified ***Frame Rate***, ***Mode***, and ***FW%max*** value.

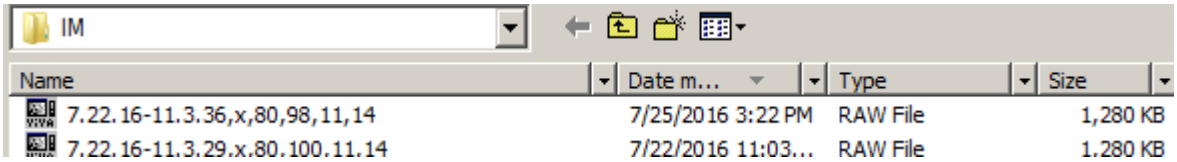
USE: on startup the program automatically starts up, ove to the RH monitor. Operation during the Run is automatic and requires no operator intervention. If there is a problem and the program appears to malfunction or populate calculated values slowly, it is wise to stop and restart the program → click STOP, then , then . Then FlatPanelCamera - Shortcut to restart the program.

DETAILS: Normal operation is indicated bu Flat Panel Error HCP_NO_ERR, Grabber State HCP_REC_RECORDING and Windows Task Manager Memory use is <200,000 K.



Use 

select and analyze any previously stored image →



4.1. Materials:

No expendable materials or supplies are required for operation of the Test Set. There may be a need to inspect and/or replace HV gaskets on the HV tube connector. Please consult tube production and engineering personnel for all questions concerning proper installation of the HV tube cable.

4.2. Emergency Shutdown:

First **defeat HV** by hitting the red mushroom button ***EMERGENCY OFF***, on the nearby HV station control panel, then click 

on MAIN, or 

on any screen, or hit the F12 function key to end the Run. 

(***MAIN***) zeroes Behlman filament power thus removing power to the Grid Tank. Shut down the computer and unplug the computer cart plugstrip and flat panel power supply inside the room. **NOTE:** Turn AC power switches **off on both Behlman Filament Power Supplies** since they are the source of Grid Tank operating HV power. This must be done always **before opening the 10KV Grid Tank** for repair.

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5.0 SAFETY

5.1. **Equipment Safety:** HV Stn interlocks are in place and protect against application of (150KV) High Voltage for stator, H.E., door switch etc. The Grid Tank is self powered by the application of filament current. In rare circumstances it is possible to have Grid voltage present inside the tank which could be exposed only if Maintenance was being performed with the tank lid circuitry out of the oil. **NOTE: Turn off both Behlman EfDr power supplies (above HV Stn keyboard) when servicing the Grid Tank**

5.2. **Potential Dangers:** Grid Tank HV may be exposed during Maintenance as explained above. Grid supplies are current limited at 100 microamps DC so it is not a lethal source, but respect it nonetheless and turn off both Behlman supplies when working with Grid circuitry exposed.

6.0 MAINTENANCE

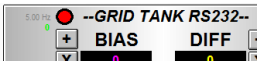
6.1. **Equipment Shutdown:** turn off both Behlman supplies as noted above to remove Grid Tank power. Shutdown computer and unplug cart power strip from 120Vac outlet. Unplug flat panel power supply from 120Vac plug inside test room.

6.2. **Materials:** HV connector gaskets, HV receptacle grease or oil, etc are the only required consumables for day to day operation. **See Nick Schwinn and Jake Sullivan for training on HV cable termination before attempting any HV cable termination.**

6.3. **Preventative Maintenance:** Maintain diala oil level in tank to the bottom of the top plate. Whenever tank lid is up for maintenance, inspect the Ext Fed Std 5 pin receptacle for visible arc holes or carbon trace damage. We have lost two receptacles and two HV cables during development and they appear to be a weak link.

6.4. **Trouble Shooting:** Most problems involve either Stangenes circuit breakers, Grid Tank, or occasionally the Flat Panel.

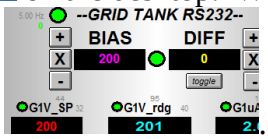
Stangenes Circuit Breakers: A really bad tube arc may trip circuit breakers feeding the Stangenes HV power supply, causing the ***KV*** and ***mA*** meters to go dark on the HV control chassis. Reset power panel 3H27 circuit 11 ***"HI CT Test Room 15 Power Supply"*** as well as ***"AC POWER IN CB1"*** on the Stangenes ***SCR Box***.

GRID TANK RS232 is 'RED': 

indicates lack of power to grid tank or a damaged tank. Must have ≥ 1.8A of filament current in order to power the grid tank 

. **CHECK:** Is the **HV cable connected** to the Switch Tank position corresponding to the operating Behlman? Is the **Behlman output at 000 Volt?** → click 

to turn on 40-45V. Is **Behlman *OUTPUT* switch** OFF? Is the tube **filament open** (it happens)? If the light is still red with adequate filament current, it is possible that the RS232 comm port is latched up. Shutdown and restart the computer, then hit 

on the desktop. When RS232 light is green, Test Grid Operation by typing in ***BIAS*** = 200V → 

. → **G1V_rdg = G2V_rdg = 200**. If grid communications is still red, the grid tank lid will have to be pulled and modules inside the "box" inspected. Failures to date have been (1) **+15V power supply**, (1) **10KV HV supply**, (1) **100 ohm 50W resistor**, (2) **4ch analog input** modules, (2) **Ext Fed Std receptacles**, (2) **RS232 Fiber Optic Drivers**, and (2) **HV cables**. With 2A nominal filament current there should be **100-200Vac at the input of the +15V power supply**. Next check the **+15 V output** from the supply. If the output is shorted, pull the connection sockets from the HV power supplies and disconnect +15V from **analog input and output** modules. Reconnect them one at a time to isolate any failed modules. When all circuitry is functional red flashing communications LEDS should show on both analog modules. The fiberoptic cables between the RS232 Fiber Optic Drivers are crossed "***Receive*** to ***Transmit***" on both ends and the Tank Fiberoptic Driver is switched ***DTE***, while the computer end driver is ***DCE***.

FLAT PANEL CAMERA: 

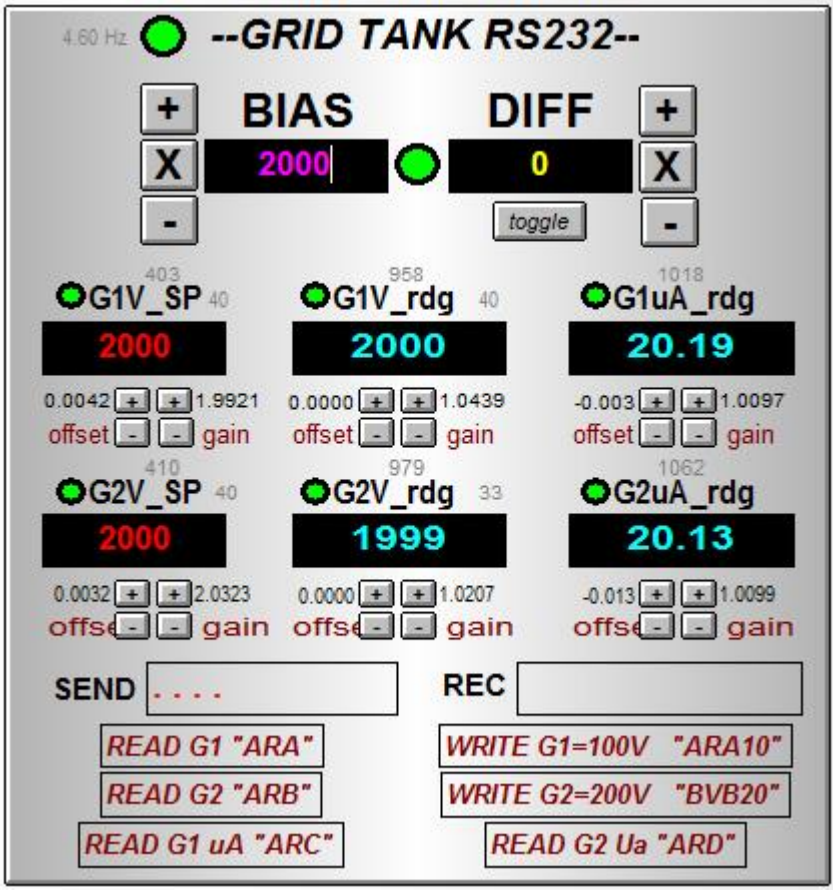
or 

may indicate the Labview program or Flat Panel is not functioning. Or ***Width***, ***Length***, etc. readings may seem to update sequentially instead of all at once. Generally the thing to do is close the program and re-launch it. First, **make sure there is power to the flat panel itself**, sometimes the AC plug to the DC power supply gets wiggled loose. The power supply is cable tied to the camera frame beneath the flat panel and power is indicated by a green LED. To **close the Labview program**, click 

, then 
(top LH corner), and 
(top RH corner). To **restart the Labview program**, click 
on the desktop (RH monitor). The program will come up on the LH monitor, just move it to the RH monitor for consistency.

7.0 CALIBRATION

7.1. **Grid Calibration:** **basically G1V_rdg and G2V_rdg are calibrated. Then G1V_SP and G2V_SP are adjusted to match.**

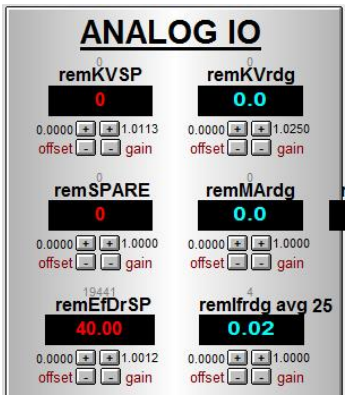


XT229 (TED) CALIBRATION w/ ROSS E0868 15KV DIVIDER & FLUKE 8846A JG 5.17.16

1. **Only CAL *G1V_rdg* & *G2V_rdg*, tol=1% rdg + 5V. Set *offset* @200V and *gain* @3500V**
2. **NOTE: TURN OFF BOTH BEHLMANS (power) WHEN MAKING CONNECTIONS→ no interlocks**
3. **Use pigtail adapter at Grid Tank (TED keeps) w/ 1 ohm 50W FIL load. COM→GND, Gx HOT(neg)**
4. **Connect E0868 Ross 15KV div between Gx & COM, output to Fluke DMM, Vdc autorange**
5. **Use Tubetype #37, turn on Behlman (40V), type in *BIAS* which sets both G1V and G2V**
6. **Check *GxV_rdg* @ 200V, 1000V, 2000V, 3000V, 4000V → worst case today is about 10V off**
7. **If needed, adj *offset&gain* on *GxV_SP* so GxV output rdgs match SP (no official calibration)**

7.2. **Non-standard Calibration:** **The Stangenes HV power supply KV and mA meter readings are calibrated separately. *REM* analog control interface interacts with Room 15 *KV*, *MA*, *If*, and**

EfDr **signals and reflects these other calibrated signals. These signals are not calibrated, but are adjusted to reflect the readings on Room 15 controls, which are calibrated.**



REM **analog signals from Room 15 HV Stn**

8.0 DOCUMENTATION

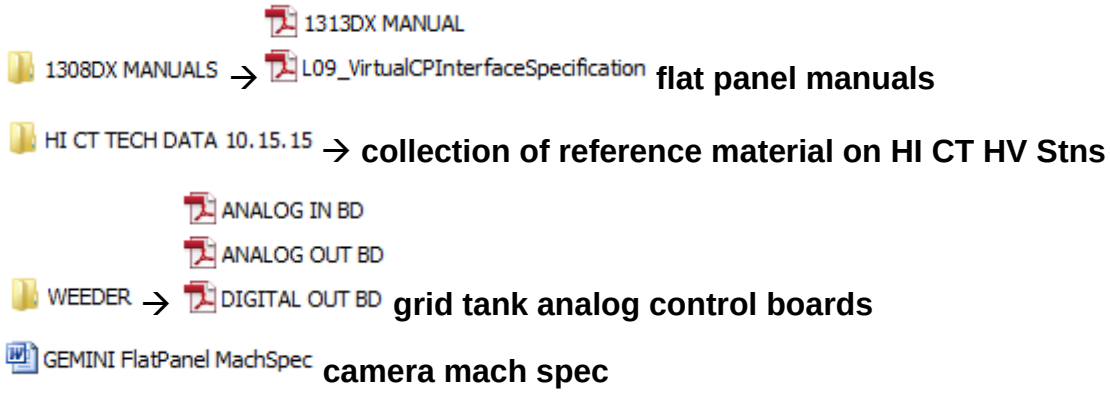
8.1. Drawings:

C01309322093 sh1	MCS-2093 equip-SYSTEM DWG
C01309322093 sh2	MCS-2093 equip-GRID TANK
C01309322093 sh3	MCS-2093 COMPUTER CART
E03609190001	Gemini Flat Panel Focal Spot Camera Assembly
E03609190002	Gemini Flat Panel Focal Spot Camera Details
E03609190003	Gemini Flat Panel Focal Spot Camera Details
E03609190004	Gemini Flat Panel Focal Spot Camera Dimension Details→

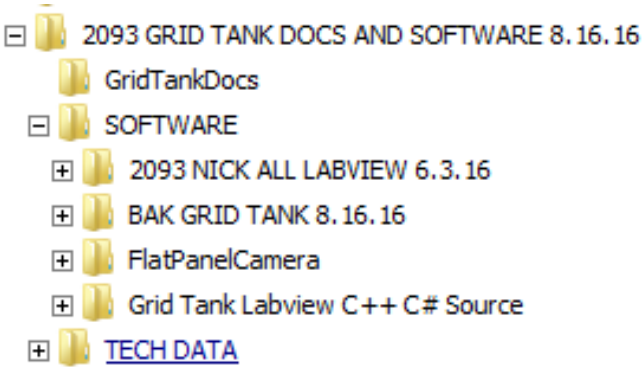
8.2. **Manuals:** Manuals and extensive reference data are stored on the network at **M:\JG\2093 GRID TANK\TECH DATA** as well as locally on the XT229 computer:

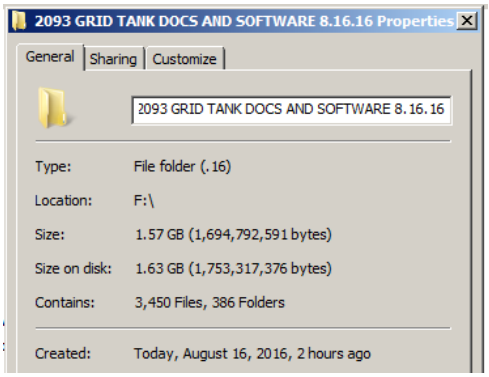
On the ***IO / Docs*** screen click 

which opens **Desktop\Tech Data**



8.3. **Software:** Paul McDaniels will maintain backup of the entire XT229 computer. In addition, the following "**2093 GRID TANK DOCS AND SOFTWARE 8.16.16**" folder contains software files as of 8.16.16. Copies of this file as shown below are maintained on **XT229 C:**, J Graham **16G Corsair** flash drive, J Graham desk computer, and **M:\JG\2093 GRID TANK DOCS AND SOFTWARE 8.16.16**





8.4. **Parts List:** See Grid Tank Drawings for full parts list. The following Spare Parts List will be established in Maintenance Stock Room. John Graham may have additional spares in his cubicle if needed.

XT229 GRID TEST RECOMMENDED SPARE PARTS

Owner(s)	Document Number	Revision
HI CT MFG Department	20004412	-

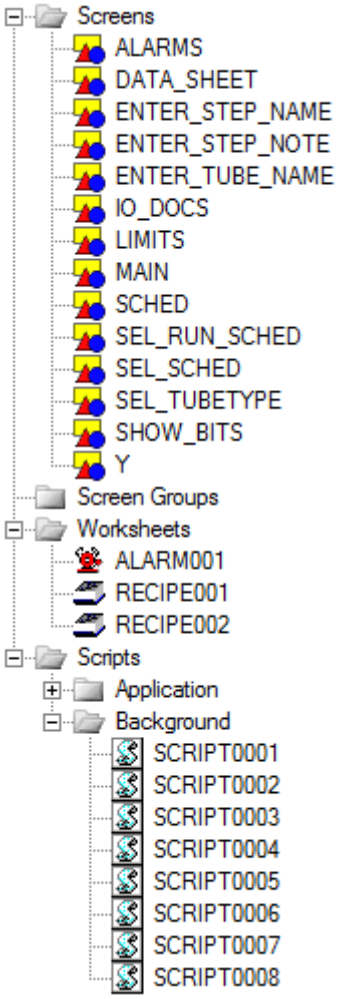
ECO # - Description	Revision Date
ECO #– Establish	08/16/2016

	#	QTY	VENDOR	PART NUMBER	DESCRIPTION	COST	TOT
TWO	1	1	Dielectric Science	1995C3-14	Varian 115509 HV cable, ExtFedStd to MCS2093,14'	$3,040	$3,040
TWO	7	1	Parker Medical	H2183PX5-160	ExtFedStd 5 pin Receptacle, 160KV	$250	$250
ONE	13	1	Newark	83F8587	Hammond 185E10, 80va Xformer, (2)115V:(2)5V@8A	$25	$25
TWO	16	1	Newark	47X2614	XP Power EML15US15-S, 15V@1A DE Power supply	$47	$47
TWO	17	2	Emco	CB101N	-10KV @ 100uA, HVPS, <225 Ma (11.5V-16V)	$385	$770
TWO	25	2	Telebyte	9271	RS232 Fiber Optic Driver, auto powered	$119	$238
ONE	26	2	Telebyte	xxxxxxxx	Fiber Optic cable, 30' long, ST connectors	$180	$360.00
TWO	27	1	Weeder	WTDAC-M	4 ch Analog Output, 12 bit, RS232	$119	$119
TWO	28	1	Weeder	WTDAIN-M	4 ch Analog Input, 20 bit, RS232	$129	$129
TWO	31	2	Newark	29C4660	NTE Electronics NTE5296A, 50W Zener, 200V	$37	$74

PLEASE MAINTAIN SPARES QTY AT LEFT FOR THESE ITEMS

FLOWCHART LISTINGS

SCREEN STUFF



Owner(s)	Document Number	Revision
HI CT MFG Department	20004412	-

ECO # - Description	Revision Date
ECO #– Establish	08/16/2016

MCS-2093 AUTO GRID TEST DWGS

C01309322093 sh1 MCS-2093 equip-SYSTEM DWG

C01309322093 sh2 MCS-2093 equip-GRID TANK

C01309322093 sh3 MCS-2093 COMPUTER CART

FLAT PANEL CAMERA DWGS (ref)

E03609190001 Gemini Flat Panel Focal Spot Camera Assembly

E03609190002 Gemini Flat Panel Focal Spot Camera Details

E03609190003 Gemini Flat Panel Focal Spot Camera Details

E03609190004 Gemini Flat Panel Focal Spot Camera Dimension Details