Users Guide for MTS 858 load frame at Sector1

WARNING: This machine is a severe pinch point hazard! It is capable of applying 15kN, or 1.5 metric tons, of force in the specimen region, between the upper crosshead and baseplate. DO NOT operate this equipment unless you are trained in its use from sector1 staff. This guide is intended to complement, rather than replace, sector training.
Note that at any time you can turn the unit off using emergency stop buttons, located:

1. **On the MTS controller box**
2. **On a cable/button connected to the controller box; it is recommended that this button be placed close enough to the load frame so that a user working on it could activate the button.**
3. **On the hydraulic power unit.**

The 858 load frame sits on an optical table which provides y-motion and some tilt capability, with additional x-x2-z-phi motions between the table and frame. The load frame is controlled by a MTS flex test controller, which is in turn attached to a PC (MTS-PC). The load frame is powered by hydraulic fluid at up to 3000 psi from a hydraulic power unit (HPU), which is located just upstream of the 1-ID-C hutch. The HPU is water cooled using DI water. Next to the HPU there is a large manifold where output fluid is routed, using manual lever switches, to one of two sets of (3) hydraulic hoses. This allows the frame to be operated in one of two locations: (a) in the C-hutch (b) just upstream of the C-hutch. There is also a water manifold attached to the table, which is used for cooling the IR furnace which can be operated with the MTS (details on furnace are in a separate users guide).

Step-by-step use instructions

1. Install load frame table and controller together in one of the two locations. Attach the 3 hydraulic hoses to the small manifold attached to the table. Ensure that the manual switch on the large manifold (just upstream of the C-station) is in line with the set of hoses being used (red levers should be parallel with hose directions you wish open/active, perpendicular with hose directions for closed lines). Attach the HPU cable from the controller to the HPU unit (DB-9 cable labeled 'MTS-HPU').
2. Connect the MTS computer's main ethernet port to the rear of the MTS controller (port labeled RST 10/100), with an Ethernet crossover cable. This (red) cable is already installed and labeled in the 1-ID-C or 1-ID-E hutch, when using in this location. The other end of this cable should attach to the internal Ethernet port on the MTS-PC (not the slot Ethernet card).
    a. Optional: connect digital I/Os to 2 ports (J54/J55) in rear of MTS controller; these are labeled in C/E-station. They are connected to epics through acromag in/out channels 10, 11 and 12.

   b. Optional: connect BNC outputs 1-5 from controller to Keithley multimeter. These allow MTS signals to be recorded in epics.
3. Turn on controller (switch on back). After warming up ~30s it should give the MTS logo.
4. On MTS-PC, open station manager (Icon on desktop). You will be prompted to select a station and parameter set. Station options
   a. Argonne default accel – uses 15kN load cell (with associated acceleration compensation), with two axial control channels (force and displacement).
   b. Argonne default with extensometer accel – same but adds third channel, for strain control (use if using extensometer or strain gage)
   c. Use either of the above under 'no accel configs' directory if using another (lower capacity) load cell, which should be mounted directly under the 15kN load cell. As of the date of this guide, sector 1 has also a 1kN load cell and 5kN load cell.
      i. Consideration for parameter sets; if a returning user, suggest finding an old one of yours and loading it. If nothing exists, pick a set created relatively recently, and once you configure your station (see below) remember to save your parameter set for future use. Filename should be of form [user_date].
5. Turn on the hydraulic power.

Warning - the fluid is pressurized at up to 3000 psi. Be sure that lines are connected to the MTS unit, and check for any possible leaks after turning on.

   a. First you must check the 'exclusive control' box on station manager.
   b. Then first turn on the HPU, first low level (middle box), wait a couple seconds, then high level (right box). If you hit any limits/warnings their will be a description on the bottom of station manager. To resolve: hit the 'reset' button to see if they clear; if not either (i) contact staff or (ii) check the limit detectors to see if you can resolve the error.
   c. Next turn on the hydraulic service manifold (HSM), same procedure as for the HPU. Now the unit is powered and the crosshead can move.
   d. Pressure can be changed from 1000-3000psi by hand turning the black handle at the HPU unit. Do not go below 1000psi.
6. To operate the MTS
   a. First set the limits and resulting actions for force/displacement and strain. These are accessed using the 2nd-to-left icon ('detectors') under 'station controls' in the Function Generator.
   b. Optionally, you can zero-offset values using the left-most icon ('auto-offset').
   c. The current values for force, displacement, strain and command are shown on meters (all may not show up pending how the meters are set-up).
   d. Using the Function Generator mode;

i. Set a control mode (displacement/force/strain). Strongly suggest using displacement unless you are sure you know what you are doing with the other modes!
ii. Set the command type (cyclic is default). Using cyclic, note that you must set the amplitude to 0 to avoid fatigue cycling.
iii. Then type in or use the slider to set the target setpoint. Note that you must hit return after typing in the setpoint for the result to be recorded. Under displacement control, positive moves up, negative moves down, and the full range (stroke) is 100mm.
iv. Once you are satisfied with the target value (and compare it to the current value on the meter) ***– first confirm that the MTS pinch area is clear*** - and then hit the arrow button under function generator (next to the red stop button); the machine will then move to the target value. Hit the red stop button to deactivate the function generator).
v. If value is not reaching the setpoint system tuning parameters may need to be changed; ask staff about this (in short, P and I gain may need to be increased).

e. Using Multi-purpose testware
i. MPT is beyond the scope of this document, but in brief it can be used to set up macros/programs to run the MTS. Included are digital I/Os which allow the program to be synchronized to spec/epics via the J54/55 connectors. It can be accessed under the 'applications' pull-down menu on station manager.

7. Help and documentation:
a. On MTS-PC, documentation located on *C:\ftse* and subdirectories.
b. Beamline personnel can be contacted at numbers listed at beamline.
c. The MTS helpline is 800-328-2255; our site # is 519558. Be sure to let the beamline staff know (preferably before) you make any calls, and record the helpline case #.