



FERMILAB
Technical Division

MQXF Magnet Interface Document

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Revision History

Revision	Date	Section No.	Revision Description
1-3	04/06/15	All	Initial Release
4	08/04/15		Connectors on the lambda plate are described CVT part modified
5	08/17/15	FVT	FVT pin assignment modified

DRAFT

PURPOSE

The purpose of this document is to provide information for assembling Hypertronic connectors on MQXF(S) quadrupole magnets.

SCOPE

This recommendation should be applied to all MQXF(S) magnets for testing at Fermilab's Vertical Magnet Test Facility (VMTF) using the recently upgraded (April 2015) 30 kA header assembly.

Individual Hypertronic modules will be first installed during the coil fabrication, then they will be combined in a Hypertronic connector after the magnet assembly. Later on so called "pigtail" cables will be prepared in order to fit the Hypertronic connectors on the 30 kA header assembly at Fermilab.

INTRODUCTION

Magnet or coil instrumentation is connected to the test facility's DAQ system through several Hypertronic connectors installed on the bottom surface of the lambda plate. Below modules of these connectors are described. All modules in a connector are assumed to have the same sex, and all connectors on the header side are "female" connectors.

5-pin "female" module, part # **LAFSTAH**:

Configurable (coil) voltage taps (CVT)

Fixed voltage taps (FVT)

Spot heaters (SH), Voltage signals from protection heaters

17-pin "female" modules, part # **LDFSTAH**:

Coil strain gauges (SG)

RTD sensors installed at Fermilab

2-pin "female" modules, part # **LMFSTAH**:

Protection heaters (PH)

In some connector assemblies described below the single unit-wide empty (blank) Hypertronic modules will be used, part # **LAHT**.

Wires and connectors are uniquely labeled according to supplied schematics. Pin diagrams and labels unambiguously describe the orientation of each module. Key modules on both ends of the connector unambiguously describe the orientation of "male" and "female" connectors.

Wire length of the magnet instrumentation or “pigtail” cable should be enough to reach the “female” Hypertronic connectors on the header assembly. Usually 4 feet long wires after the magnet lead end is sufficient.

The “male” Hypertronic connectors should be properly protected and wrapped in a protective material when magnet is shipped.

Important:

Currently pin orientations are not indicated in the key modules

DRAFT

CONFIGURABLE VOLTAGE TAP (CVT) CONNECTORS:

There are two CVT connectors CVT1 and CVT2. Each connector consists of 15 Female 5-pin modules (part # **LAFSTAH**) and key modules on each side of the connector. The first and last modules in each connector are blank (empty module, part # **LAHT**). CVT connector diagrams (**solder-cup view**) are shown below. Wire direction is also shown.

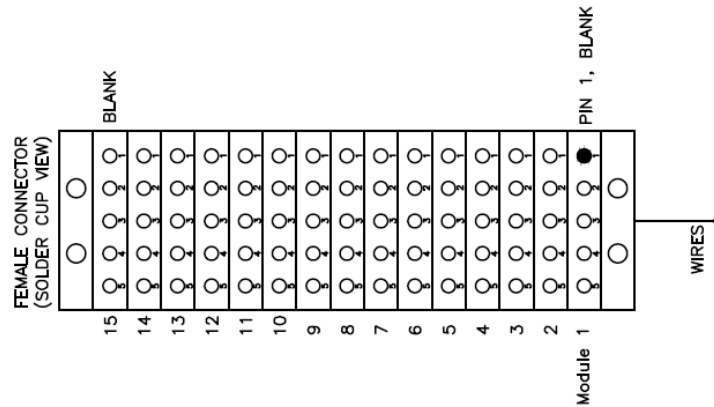
The first voltage tap at the Positive power lead has to be wired to the module 2, pin 1 of the CVT1 connector. Then wiring makes a serpentine form: consecutive voltage taps in two adjacent 5-pin modules will be wired in opposite direction. For example, wiring will go from pin 1 to 5 in the module #2 and then from pin 5 to 1 in the module #3 of CVT1 connector.

CVT1 and CVT2: Module 14, pin 1 should not be wired.

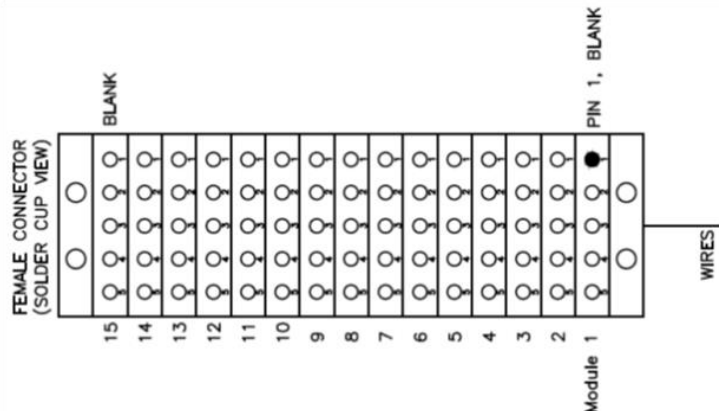
Modules from 11 to 14 in CVT2 are spared for the redundant splice voltage taps and will be wired at Fermilab.

Total number of wired CVT channels should not exceed 128.

CVT1:



CVT2:



Example of the CVT pin assignment for a single coil is shown below.

V-Tap	Conn.	Module	Pin	V-Tap	Conn.	Module	Pin
VT01	CVT1	2	1	VT06	CVT1	3	5
VT02	CVT1	2	2	VT07	CVT1	3	4
VT03	CVT1	2	3	VT08	CVT1	3	3
VT04	CVT1	2	4	VT09	CVT1	3	2
VT05	CVT1	2	5	VT10	CVT1	3	1

HEATER CONNECTORS:

There are two 11-module Strip Heater connectors STRIP HTR1 and STRIP HTR2, and one 12 module connector for Strip and Spot Heaters STRIP/SPOT HTR3.

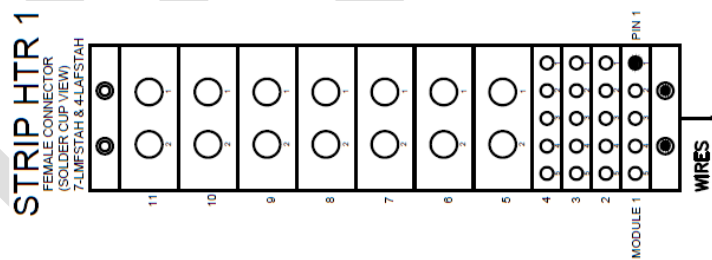
Connectors STRIP HTR1 and STRIP HTR2 consist of 7 2-pin modules used for the strip heaters and 4 5-pin modules for the voltage signals from the strip heaters.

Connector STRIP/SPOT HTR3 consists of 6 2-pin modules used for the strip heaters and 6 5-pin modules for the spot heaters (modules 1-3, module 4 pin 5) and voltage signals from the strip heater (module 4, pins 1-4 and modules 5-6).

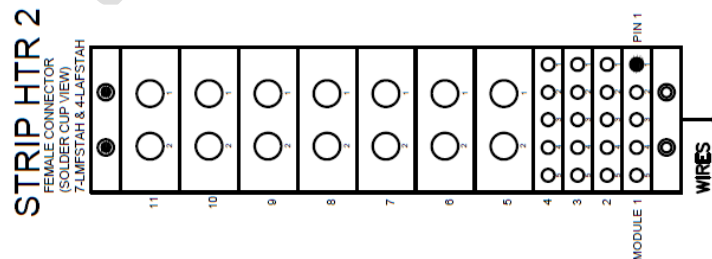
5-pin modules 1-5 in connectors HTR1 and HTR2, as well as modules 4-6 in HTR3 will be wired at Fermilab.

There are also key modules on each side of the connectors. Heater connector diagrams (solder-cup view) are shown below. Wire direction is also shown.

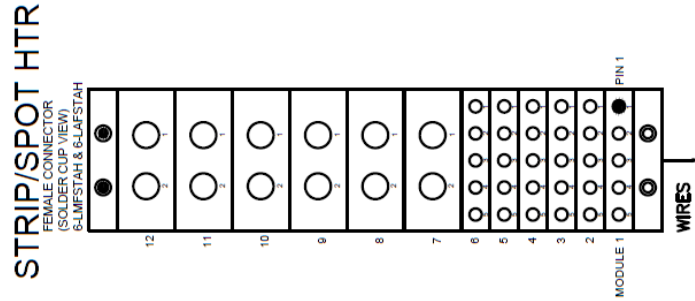
STRIP HTR1:



STRIP HTR2:



STRIP HTR3:



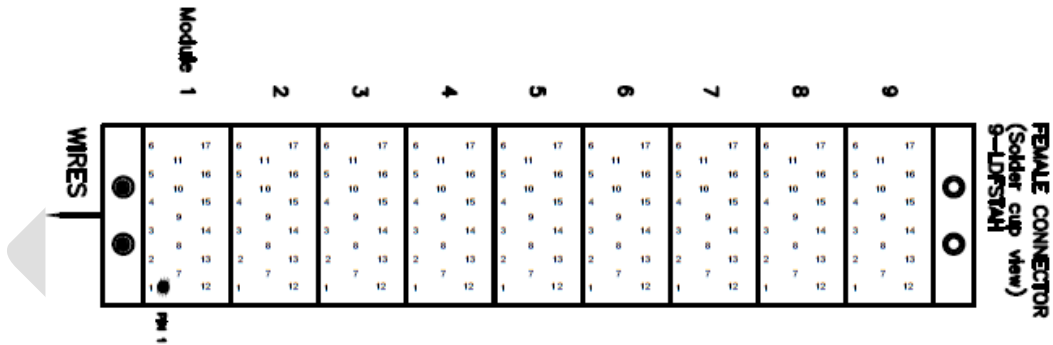
STRAIN GAUGE CONNECTORS:

There are two 9-module strain gauge (SG) connectors SG1 and SG2. Each 17-pin Hypertronic module (part # **LDFSTAH**) can accommodate 4 strain gauges. There are key modules on each side of the connector.

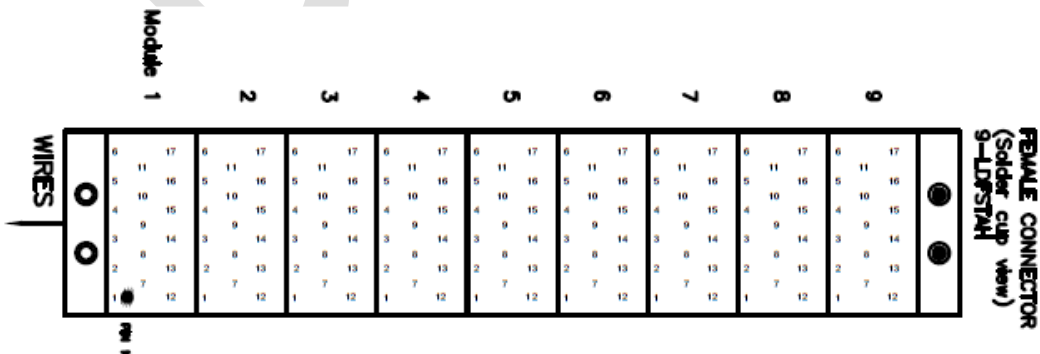
Important: Maximum of 63 SG are allowed currently due to limited number of channels in the switch boxes.

SG connector diagram (**solder-cup view**) is shown below. Wire direction is also shown.

SG1



SG2



Example of SG Connector Pin Assignment in one 17-pin module is shown below:

Coil	SG	Conn.	Mod.	Pin	WIRE COLOR
1	SG1	SG1	1	12/13/14/15	R/B/G/W (I+/I-/V+/V-)
1	SG2	SG1	1	16/17/11/10	R/B/G/W (I+/I-/V+/V-)
1	SG3	SG1	1	9/8/7/1	R/B/G/W (I+/I-/V+/V-)
1	SG4	SG1	1	2/3/4/5	R/B/G/W (I+/I-/V+/V-)

FIXED VOLTAGE TAP (FVT) CONNECTORS:

There is one 15-module connector for the Fixed Voltage Taps (FVT). These 5-pin modules (part # **LAFSTAH**) are used for the whole-, half- and quarter-coil signals, which will participate in the quench detection and protection systems. The half-coil signals for the voltage spike detection system also will be wired in this connector. FVT connector diagram (**solder-cup view**) is shown below. Wire direction is also shown.

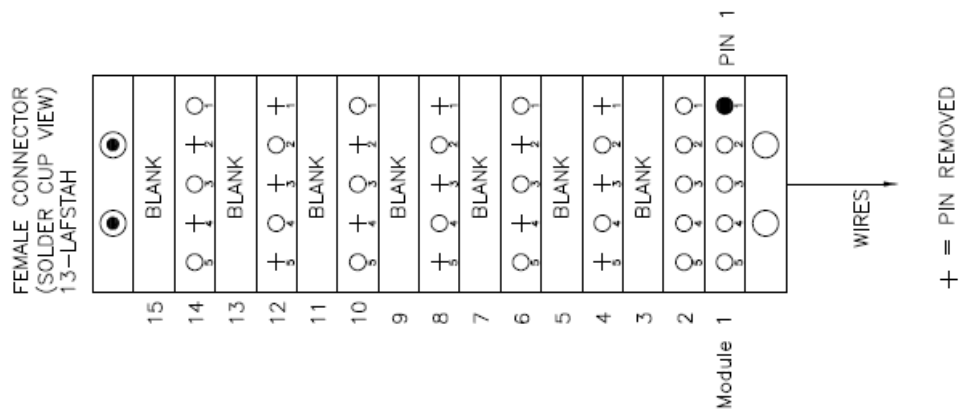
Important: FVT segments will see the largest voltage drop in the magnet, therefore the FVT modules are alternated with the blank modules in the connector. In addition, individual pins are also alternated with the empty pin-space (see below)

FVT connector will be wired after the coil leads are spliced together in the “pizza box”.

Important:

Modules 6 and 8 with the spike signals will be wired at Fermilab.
Modules 1, 2, & 4 are not used.

FVT



FVT Connector Pin assignment for the magnet (5 modules)

FVT	Mod.	Pin
WC+	14	5
¼-	10	3
¼+	14	1
½-	10	5
½+	12	2
¾-	12	4
¾+	14	3
WC-	10	1
Spikes	Mod.	Pin
WC+	8	2
½-	6	5
½+	8	4
WC-	6	3

FVT twisted pairs: (WC+, 3/4+, 1/4+, 1/2+) & (1/2-, 3/4-, 1/4-, WC-)