STAR Electronics Cable Summary

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Abstract: The RHIC Safety Committee has provided guidelines for cables that can be installed in STAR. This document describes some on the commonly used cables that can be used in STAR.

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The RHIC Experimental Safety Committee has provided guidelines on the use of electrical cables. The RHIC SEAPPM 1:5.0.1 Attachment 1:3 3/16/93 pp. 16-18 describes what cables are appropriate for installation depending on the cable type and voltage and current. Any cable that is described in this attachment can be used as long as the voltage and current rating are appropriate. In addition to this guideline, the RHIC Experimental Safety Committee has approved a collection of specific cables for use in STAR.

The information presented in this note contains guidelines. ***Before any cable is procured either the STAR electrical safety committee or the RHIC electrical safety committee should review the cables.***

In the STAR cable installation, we have determined that we will have three classes of cables in cable trays running from the Electronics platform to the detector:

1. Standard High Voltage — (all cables must be rated to 5 kV DC)
2. Low Voltage and Signal — (all cables must be rated to 300V insulation)
3. Fiber Optic

The TPC will also have one 85 kV DC cable treated separately from the tray cables. The FTPC will also have a 35 kV DC cable that will be treated separately.

1.1 Cable Trays (outside the detector)

Trays are divided into two sections. One is for high voltage and one is for low voltage power and signal. There are stringent requirements on the power cables limiting currents to less than 5 amps unless specifically otherwise authorized. The fiber cables can go into either tray. We are planning to put them in the high voltage tray.

1.2 Cable Paths (inside the pole tips)

Once the cables are inside of the detector, NEC rules for cable trays no longer apply. NEC rules for enclosures do apply. RHIC recommendations and requirements for electronics chassis do apply. Please refer to the RHIC SEAPM for guidance.

2.1 Standard High Voltage

These types of cables are the standard ones that we use in experiments. The maximum voltage for these types of cables is 5 kV DC. The RHIC SEAPPM INCORRECTLY (as of September 30, 1998) specifies RG-59B/U with a red jacket. The correct specification is RG-59/U with a red jacket. RG-59/U has a CL2 rating.

usage	part number	desc.	gauge	insulation	code type
high voltage	red RG59/U (BNL standard)		coax		

2.2 Low Voltage and Signal

The cables may be TC rated, CL2, etc., as listed in the SEAPPM. The voltage rating must be 300V or higher insulation. The following cables have been specifically approved by the RHIC Experimental Safety Committee.

usage	part number	desc.	gauge	insulation	code type
HDLC cable	Alpha 6392	4 pair.	28 awg	300V	CL2 (CL2 rating mitigates 28 awg)
CLK/Trigger	Belden 9M281xx		28 awg	300V	CL2 (CL2 rating mitigates 28 awg)
low voltage power	Alpha 7556	7 cond	12 awg	600V	NEC art 340 Class 1, Division II

Normally, 28-gauge cable is not allowed in cable trays. However, because we are using a CL2 rated outer jacket, we have been permitted to use this smaller diameter cable.

2.3 Chassis Cables:

Standard good engineering practices shall be followed using flame resistant and flame retardant material (rated VW1 or better). These cables are installed inside of the detector and not in trays. The following cables have already been approved.

usage	part number	desc.	gauge	insulation	code type
low voltage power	Anixter 2ZN-1407	7 cond.	14 awg	600V	TC
flat cable	Belden 9L26068	68 cond	26 awg	300V	VW-1 flame test
flat cable	Belden 9R280 series		28 awg	300V	VW-1 flame test

2.4 Optical fiber

These cables must have fire resistance as specified in the SEAPPM (type OFN or OFC). The TPC FEE has specified OFNR. The SVT will share some of the fibers in the TPC FEE cable.

Appendix A Example of approved cables

The following cables have been approved for use in the STAR SVT. Please note the VW-1 fire ratings, the UL listings and specific requirements for high voltage testing.

usage	part number	desc.	gage	rating	operating	current/cond	connector	Code type
High Voltage section: from Rack Electronics to Read Out Modules								
high voltage	red RG59	coax		2300 Vrms	1.5 KVDC	< 9 ma	SHV	BNL standard
Low Voltage and signal section : from Rack Electronics to Read Out Modules								
HDLC cable	Alpha 6392	4 pair	28awg	300 Vrms	< 5 VAC	< 100 ma	3M	CL2
Calibration cable	Alpha 6390	2 pair	28awg	300 Vrms	<1 5 VDC	< 100 ma	3M	CL2
CLK/Trigger	Belden 9M28126	13 pair	28awg	300 Vrms	< 5 VAC	< 100 ma	3M	CL2
optical fiber	fibertron (similar to TPC)	6,8 fiber	-	-	-	-	-	OFNR
Low Voltage power	Alpha 7561	12 cond	12 awg	600 Vrms	8.5 VDC	< 5 amp	molex	UL vertical tray flame test
Low Voltage power	Anixter 2ZN-1412	12 cond	14 awg	600Vrms	8.5 VDC	< 5 amp	molex	TC
Cone Cables: from Read Out Modules to Transition Cards								
HV power	RG 179	coax	0.1" dia.	900V rms	1.5 KVDC	< 9 ma	SHV	Belden 83264 - VW-1
Low Voltage power	Alpha 5070C	10	18 awg	300 V	8.5 VDC	< 1.2 amp	molex	UL VW-1
Low Voltage power	Alpha 5010C	10	22 awg	300 V	8.5 VDC	< 1.2 amp	molex	UL VW-1
RDO internal signal	Intercon	10,20,30,50 cond-flat	30awg	150V	< 5 VAC	< 100 ma	Interconn	UL 20726,UL1581 (VW1)
signal	Temp-Flex FPX3301S-1P	50 pr	33 awg		<5 VAC	< 100 ma	Interconn 100 pin	UL 10186,UL1581 (VW1)
Detector Cables: from Transition Cards to Detector Half Ladders								
High Voltage power	NEEW N12-38T-116	harness	30 awg		1.5 KVDC	< 9 ma	TBD	hipot req'd - 100% teflon
Low Voltage power	Belden 83043	harness	30 awg	300 V	8.5 VDC	< 300 ma	samtec smt	ET, 200C, UL VW-1
signal	Belden 83041	harness	32 awg	300 V	< 5 VAC	< 100 ma	samtec smt	ET, 200C, UL VW-1