Auxiliary Power Systems for CIP

Bob Lounsbury
Rockwell Automation

Technical Track

www.odva.org

Abstract

The need for high auxiliary power has become very common on communications devices. The customer base has been requesting that components be standardized including permissible noise limits. The Physical Layer SIGs have been working together to develop a Auxiliary power system for all CIP based networks. As a result a new distribution system is emerging within ODVA with the sole purpose is to distribute power to devices. This system defines power supply requirements, cabling requirements including connector pinning and topologies. This paper covers the technical aspects with this new power distribution system

Auxiliary Power Systems

Topics Covered

- Introduction
- System topologies
- System components
- Wiring examples

Introduction

Background

- 24V AUX power systems are widely used for;
  - E-Stop Systems,
  - I/O source power,
  - Device Auxiliary power,
  - Actuators (liquid and air valves),
  - Power control,

Introduction

Problem

- Controls and Actuator Vendors install Auxiliary power connectors on various control devices
- Cabling vendors provide cables for all systems and applications
- Cables, connector pin definitions are not standardized and therefore in many cases are not always compatible.

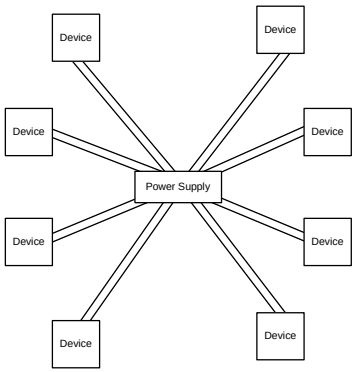
Solution

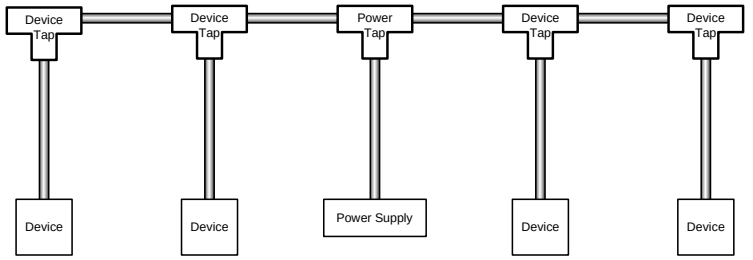
- Physical Layer SIGs have released a Standard into the CIP common chapter 8 chapter.
  - Publish in April 2009
  - Common to all CIP networks
- Initially informative
  - Check mark on products indicating conformance
  - Future will be come normative

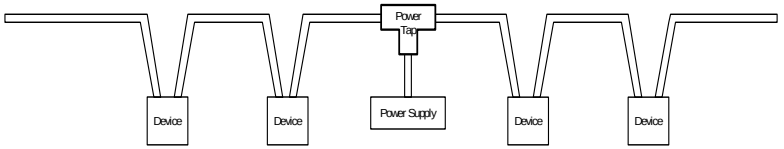
Physical Topologies

Three Common topologies supported

- Star
- Linear Bus
- Daisy Chain







System Components

Connectors

- 4 Pin
  - Mini (7/8 mini)
  - Micro M12-4 “A” coding

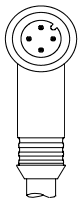
Male 90 degree view

Female 90 degree view

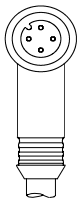
Cenelec	**Cenelec Standard**	**CIP Aux Power**
Pin 1	V+	V+ Switched
Pin 2	Signal	V+ Unswitched
Pin 3	V-	V- Unswitched
Pin 4	Signal	V- Switched

	Standard A-Coding	**CIP Aux Power**
Pin 1	V+	V+ Unswitched
Pin 2	Signal	V+ Switched
Pin 3	V-	V- Unswitched
Pin 4	Signal	V- Switched

Male 90 degree view



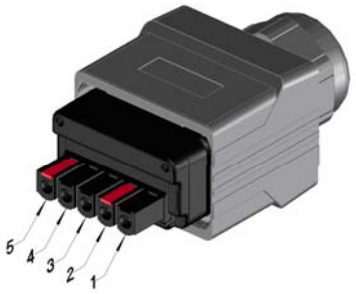
Female 90 degree view



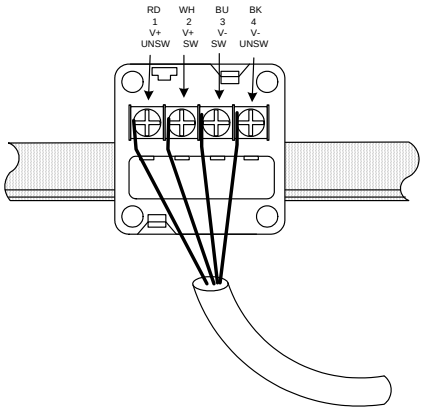
System Components

Connectors

- 5 Pin
  - 5 pin
- Flat with screw terminals



5 pin	**CIP Aux Power**
Pin 1	V+ Unswitched
Pin 2	V- Unswitched
Pin 3	V+ Switched
Pin 4	V- Switched
Pin 5	Not used

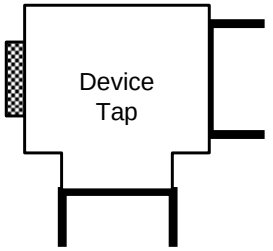


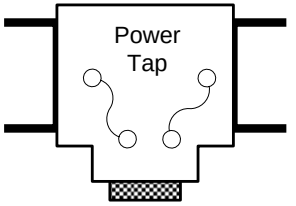
5 pin	**CIP Aux Power**
Pin 1	V+ Unswitched
Pin 2	V+ Switched
Pin 3	V- Switched
Pin 4	V- Unswitched

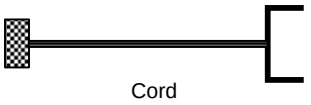
Components

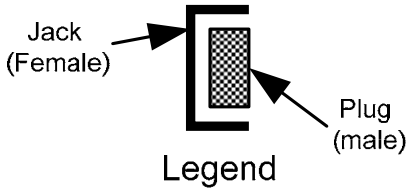
Taps (two)

- Device Taps (two jacks one plug)
- Power Taps (two jacks on plug)





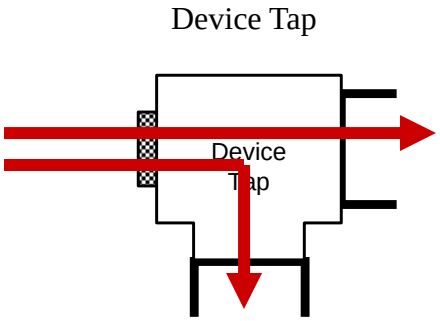


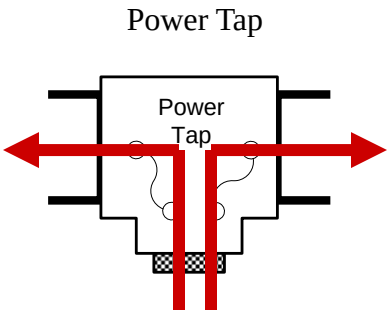


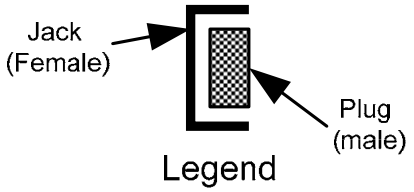
Components

Power Flow

- Designed to prevent exposed live contacts.

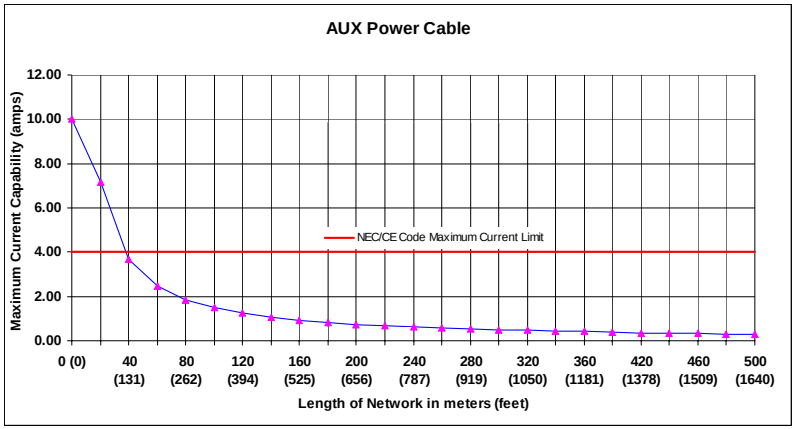






Components

Cables



- Three Cables
  - Trunk
  - Drop
  - Flat
- Can be used anywhere in the system (trunk for drop, drop for trunk)
- Each cable has unique d.c. resistances

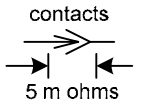
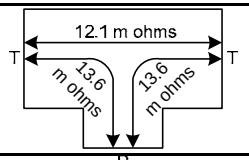
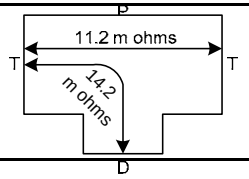
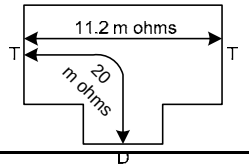
Components

Limitations

- IR drop in the system is the main limiting factor.
- Each component has DCR specifications.
- System is based on a 6V maximum drop.
- 24V-6V = 18V minimum bus voltage.

Components

DCR

Cabling Element		DCR	Note	Schematic
Connector DCR		5 mohms	Over life, per contact	
Power Tap DCR		12.1 mohms trunk to trunk, 13.6 m Ohms trunk to drop	Includes contacts and internal wiring	
Device Tap DCR	Mini to Mini 7/8	11.2 mohms trunk – trunk 14.2 m ohms trunk - drop	Includes contacts and internal wiring	
	Mini to Micro & Micro to Micro	11.2 mohms trunk – trunk 20 mohms trunk - drop		
Cable DCR/length	Trunk	16 (4.9)	m(ft)	@ 20 deg C
	Drop	22.6 (6.9)	m(ft)	
	Flat	16 (4.9)	m(ft)	

Components

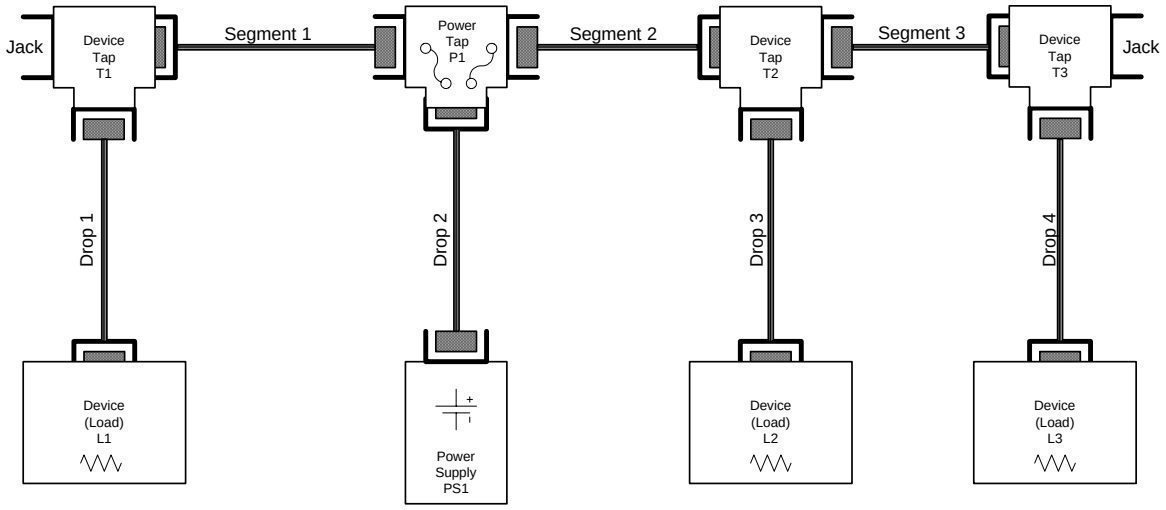
Power Supplies

- 24V +/- 1%
- Regulation and Startup parameters are defined.

Example

- Simple equations for design

$$I_{total} = I_{L1} + I_{L2} + I_{L3}$$



Calculations

- Calculating the voltage drop in each element and then adding them together.
- The voltage drop is a function of the current through each path to the load times the path resistance. Therefore the voltage drop at each load is the sum of the voltage drops between the power supply and the load.

Questions?

Thank You

Bob Lounsbury

Principal Engineer

Rockwell Automation

440-646-4297