Siemens XJ-L™ HD Busway

High Density Power Distribution for Data Centers
Prepared by Julius Neudorfer

Introduction –
Today's Data Center Challenges

The power demands of today's (and future) data centers are radically different from those of just a few years ago. Moreover, they are in a constant state of change. The days of fixed power distribution systems, using traditional hardwired wall mounted sub-panels, or even floor level power distribution units, are no longer able to cost effectively handle all the moves, adds and changes required for a modern data center.

In addition, electrical loads per cabinet can vary from 3KW to 30KW, and in some cases even higher. The subsequent high density heat loads have increased the cooling requirements tremendously. As a result, restrictions to under-floor cooling airflow caused by larger and denser power conduits or cables can no longer be tolerated.

To meet these new challenges, designers and operators are looking for a more flexible solution. Moreover, data center operators must be able to cost effectively and expediently meet users' rapidly rising power density levels as well as changing receptacle requirements, without any power system down time.

Overhead power distribution has become an option to keep the under floor air plenum free of cabling. While that improves the air flow for cooling, it does not directly address the need to provide a more flexible power distribution system capable of enduring **High Density** loads. To address this issue a more flexible alternative has begun to make inroads in the data center to meet this power distribution challenge; the busway type power distribution system.

While relatively new to the data center, bus type distribution systems have been in use on industrial factory floors for many decades, where it provided an easy method to reconfigure and add power for new machines as needed. However, only recently has it begun to appear in the data center.

These new busway products for data centers are somewhat different than the traditional large industrial and commercial busway or "busduct" systems which are normally used for main power feeds used for large scale power distribution systems.

Flexibility and Adaptability

The data center of today has IT equipment added or changed constantly to meet higher and higher computer capacity and performance requirements. With more bladeservers and larger and larger storage arrays being rapidly deployed almost overnight, the need for rapid provisioning of power has become a nearly continuous event. These new modular busway systems are specifically designed to meet these data centers requirements. They provide the ability to add or remove a plug-in power tap without interrupting the power to the bus. There are a variety of different taps to supply and support

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different levels of power. They are available in a variety of standard receptacles in both single and 3 phase power configurations, ranging from the basic NEMA style 120 volt and 208 volt 20 amp outlets to multiple IEC type receptacles.

Reliability and Availability

Of course, in the Mission Critical world of the data center, reliability and availability are paramount. One concern expressed by some is that a short or overload would cause the loss of an entire track feeding a row of cabinets. While it is unlikely to happen under ordinary circumstances in a properly managed system, this factor should not be overlooked in a non-redundant system. However, to mitigate the risk of bus overload, each tap contains a circuit breaker which protects the busway from a branch level overload under normal conditions. In reality, the same overload risk exists with a traditional sub-panel, or floor level distribution system if it is not properly managed or monitored.

In a fully redundant A-B system, each busway path must be designed to carry the entire load to allow for continuous un-interrupted operation of dual fed cabinets. Therefore, a bus level overload should not be any more of a concern than any other type of upstream power component failure in fully redundant power distribution design.

If there is one constant in the data center of today and of the future, it is change. The computing equipment evolves and is replaced constantly. Moreover, all data centers operators and IT departments are being asked to do more with less. If you are evaluating your data center's power infrastructure, either for a new Greenfield build-out or an upgrade to an existing site, busway power distribution systems should be given serious consideration.

While traditional power distribution will not suddenly disappear, flexible distribution systems are starting to make a stronger appearance, especially in new installations and upgrades. In any event, the flexibility and cost effectiveness that the busway system offers means that the data center designer has a greater variety of options to choose from.

Features and Benefits of Siemens XJ-L HD Busway

Lower Cost to Install and Maintain

Siemens XJ-L HD Busway offers a lower cost solution, compared to cable and conduit, sandwich style busway or even light duty track type busway. Snap together installation requires no special tools and is fast, easy and maintenance free. Solid, highly conductive bus bars minimize electrical losses and ensure long-term energy savings.

Modular and Flexible

Siemens XJ-L HD Busway components are available in a wide variety of straight lengths, elbows, tees and crosses. Power is tapped via XJ-L HD Power Module (XPM) that can be installed and then readily expanded or reconfigured to meet changing requirements. Furthermore, XPMs are fully interchangeable between all busway current ratings. Custom fittings and straight lengths can be application engineered to tailor the busway system to specific customer requirements.

- Overhead, under the floor, horizontal, or even vertically mounted, XJ-L HD Busway is suitable for use in all mounting orientations making it the most versatile and energy efficient power distribution system in its class.
- Busway mounting options include overhead suspension or mounting directly to the equipment rack, eliminating the need for special bracing required for earthquake rating.
- For maximum **Power Density** with a small foot print, parallel runs can be mounted in a "Top over Bottom" vertical arrangement, which allows the busway system to be installed completely over the top of the cabinets (not in the aisle).
- XJ-L™ **High Density** Busway offers up to twelve 100A XPMs installed **per 10 foot** of Busway section. Busway sections are available with six plug-in ports per side or twelve on one side.
- Moves, Adds and Changes are a snap. XPMs can be installed or relocated as required, **without de-energizing the busway**. All XJ-L HD Power Modules are fully interchangeable with all XJ-L HD Busway configurations.
- XPMs are installed straight onto the busway for easy insertion and removal and allows optimal positioning of receptacle and power cord routing.
- Pre-engineered XPM opening locations on the busway ensures no interference between XPMs for **greater density** and maximum flexibility.
- Power Modules are available with 3, 6, or 12 branch circuit protection in both single and 3-phase configurations, ranging from 15 –200 amps for maximum power density and flexibility.
- A wide variety of NEMA and IEC receptacles are available for the XPM.

Energy Efficient

- Bus bars are solid copper (98% conductivity) and tin plated for superior electrical performance and corrosion resistance (optional silver plating is also available). The solid bus bar design provides superior short circuit strength (up to 35 kA) compared to channel style conductors and cable.
- XJ-L HD Busway is 100% full load rated at 100, 225 & 400A This means that the busway will operate with less energy loss compared to products rated at only 80%.
- Harmonics from the operation of electronic equipment typical to a data center can cause over heating in the neutral and voltage distortion of the power distribution system. To combat this issue, XJ-L HD Busway can be configured with an optional 200%[1] neutral for 100, 225, & 400A busway and associated bus plugs.
- Siemens offers a full line of Power Monitoring Products that are readily adaptable to **Smart** XJ-L Power Module plugs and tap boxes.

Safe and Reliable

- With over one million feet in service, XJ-L HD Busway has a proven track record. The busway joints are easy to install and maintenance free.
- Solid copper bus bars and totally steel enclosed housings are designed for decades of dependable service.
- Totally enclosed steel housing is robust, guarding against contamination and incidental contact to live parts. Enclosed box design will not twist or distort during bus plug installation.
- Installation is fast and easy. Joint connections simply snap together without special tools, housing couplers, or bus connectors.

[1] Be aware of power distribution equipment that is not 100% full load capable and rely on 80% rated line side protection for thermal and short circuit compliance. These products generate excess heat and ultimately can cost 20-40% more to operate.

[2] Be aware of lighter duty track type busway: UL 857, defines Continuous Plug-in Busway as follows: "A continuous plug-in busway is rated at 225A or less, has no exposed bus bars, and is intended for general use, including installation within the reach of persons."

Specifications and Ratings

XJ-L™ HD Power Module (XPM) - maximum kVAratings (3 phase)		
kVA	Amps	Volts
36	100	120/208
72	100	415/240
72	200	120/208
144	200	415/208

Of course, a higher power requirement per rack means that the busway itself must be able to deliver more power to each row of cabinets. By offering the XJ-L HD Busway system components rated at up to 400 Amps, each Busway segment can deliver up to 288kVA @ 415/240V.

Busway Sections - maximum kVAratings (3 phase)		
kVA	Amps	Volts
36	100	120/208
72	100	415/240
81	225	120/208
162	225	415/240
144	400	120/208
288	400	415/240

XJ-L HD Busway is fully tested and recognized to ANCE NMX-J-148-ANCE, CSA 22.2 and UL 857.

Busway UL Current Ratings: 100, 200, & 400A

- Unlike some other lower capacity products[2] which are limited to 225 Amps, Siemens XL-J HD Busway is 100% UL rated to 400A which allows up to 77% more power distribution per busway segment, providing up to 288kVA (@415/240V), an emerging trend to meet the growing **high density** power requirements of modern data centers.

Voltage: 600V max

Bus Bar Material: Copper
Configurations: 3Ø3W, 3Ø4W

- Neutral: 100%, 200%
- Ground: Std Housing (Hsg), Internal(G), Isolated (IG)
- Ingress Protection: IP2X, IP40

Designing Data Centers with Busway

The decision to move from using traditional hardwired wall mounted sub-panels or floor level power distribution units to a busway system, requires reorienting some of the electrical distribution design concepts. It is important to understand the concepts, advantages and features in order to maximize the benefits of the Busway system.

In a traditional system the area sub-panel must be sized to the expected maximum loads and the predicted number of branch circuits. When designing a Busway system, one must still specify the maximum expected current capacity for the area (or rows) that the busway will cover, however one does not need to worry about the quantity and sizing of branch circuit breakers. All of the branch circuit distribution and circuit protect is contained in the Power Modules "XPM". These XPM modules can be moved, added or upgraded at anytime to meet ever changing IT power requirements. Furthermore, any of the XPMs are upwardly compatible with larger busway components since they are fully interchangeable between 100, 225 and 400A rated busway sections. Most importantly, XPMs can be easily and safely installed onto energized busway sections as needed, avoiding downtime for reconfiguration or new service requests.

Moreover, by placing the Busway power distribution system over the cabinets, instead of under the raised floor, it can significantly increase airflow. As result it can help improve the effectiveness and energy efficiency of the cooling system..

Note however, when considering which brand and type of system to install, it is also important to understand some of the differences between the different types of systems on the market today. Track Bus is somewhat similar to Busway, however it has certain limitations and drawbacks. Track style systems generally are lighter duty systems originally designed for lighting systems and may bend, sag or twist under heavy loads from larger or numerous power taps. They also have an open style track design with exposed conductors which can represent a potential safety hazard.

In contrast, the Siemens XJ-L HD Busway system was originally designed for heavy industrial power distribution with rigorous physical and electrical demands. It has been re-engineered to meet the specific requirements of the data center, however, intrinsically it is a robust industrial grade power distribution system. The busway openings are completely covered until needed for the insertion of the XJL HD Power Modules and there are no exposed conductors during normal operation.

Julius Neudorfer is the CTO and founder of North American Access Technologies, Inc. He has been involved with designing and implementing Data and Voice Networks as well as Data Center Infrastructure since 1987 and is the primary designer of the NAAT Mobile Data Center.

Over the last 20 years he has designed and overseen the implementation of many technology projects including data centers and network projects and specializes in improving the efficiency of the data center. North American Access Technologies, Inc., has over 2 decades of experience in designing, implementing and project management of data center and network projects. Based in Westchester NY, NAAT's clients include Fortune 500 firms and government agencies.

Julius is a member of AFCOM, ASHRAE, BICSI and IEEE and is also the founder of *THINK8760.org*, which is focused on improving data center and IT energy efficiency. He has written numerous articles for various IT and Data Center publications and has delivered seminars and webinars on data center power, cooling and efficiency and is a Certified Data Center Design Professional "CDCDP"
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Subject to change without prior notice
Order No.: BUWP-XJL01-0211
Printed in USA