

The MooreHawke ROUTE-MASTER™ Fieldbus System is a recommended option by Yokogawa to power Intrinsically-Safe (I.S.) fieldbus segments.

This application note addresses I.S. applications with FISCO and Entity devices located in Class I, Division 1 or Zone 0, Ex ia locations. The ROUTE-MASTER system consists of a safe area Power Supply (RM100) and one or more field-based Fieldbus Device Couplers. Each RM100 can support up to eight segments in a single nested system. Each segment has a dedicated isolator that can power up to 16 fieldbus™ devices in IIC areas (assuming each device draws 20mA).

Using the dual trunk, 16 devices can be powered at 500m from the same isolator. If the device coupler is located in an area classified as IIB, the trunk and spurs are rated for Zone 0, Ex ia; if the device coupler is located in an area classified as IIC, the trunk is rated for Zone 1, Ex e and the spurs are rated and certified for I.S. applications (either FISCO or Entity devices) in these Gas Groups (see Figure 1A).

The RM100 system can be rack- or surface-mounted. The RM100-Y uniquely supports direct connection to

the Yokogawa ALF111 card using the AKB336 cable including simplex or redundant configurations (shown in Figures 1A and 1B). This direct connection and mounting is exclusively available to Yokogawa and minimizes cost of installation and wiring of system racks. The dual trunk feature allows the system racks to be fully loaded without fear of needing additional rack space as segment requirements are finalized. Be sure to specify adequate lengths of AKB336 cable for each ALF111 card.

The RM100 system rack is AC-powered. Dual AC mains (terminated on RM101B) can be used with redundant DC regulators (RM102B) to provide isolated load-sharing redundant DC for each isolator. The isolator (RM103B) provides 350mA at 18.65V for each trunk. If one trunk cable is used, a trunk terminator (TRK-TERM) must be installed on the second trunk terminals. Total trunk and spur cable lengths must be less than 1900m/segment.

DC Power Considerations for I.S. Applications

The total current available from RM100 power supplies to power a field device depends on the length and resistance of the fieldbus cable. Table 1 shows the maximum distance in meters for a given load on the RM100 power supply.

Figure 1A: The ATEX approved ROUTE-MASTER system with RMA100C device couplers.

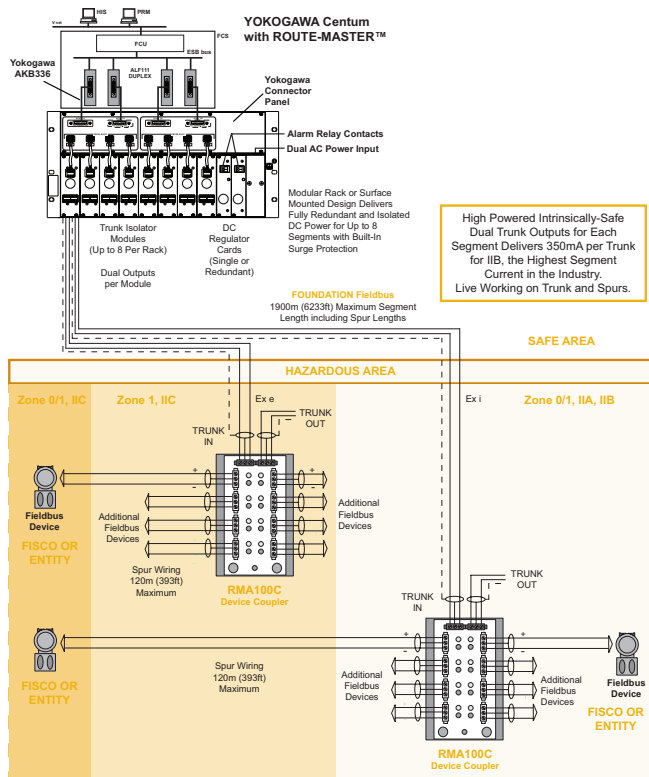
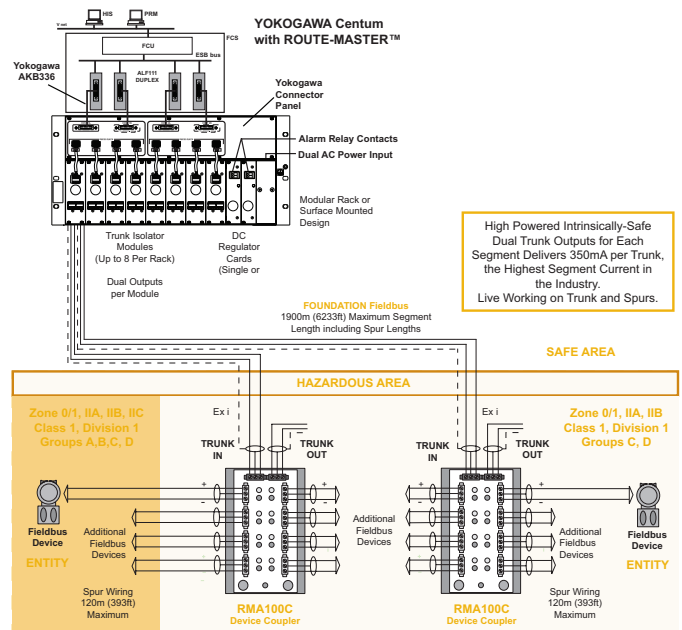


Figure 1B: FM and ATEX approved ROUTE-MASTER system with RMA100 device couplers mount in IIB (Gas Group CD) location and directly connect to devices in IIC (Gas Group AB) location to deliver 350mA per trunk into hazardous areas/locations.



Intrinsically-Safe Fieldbus Applications for Yokogawa Control Systems

The following assumptions are made:

- I.S. power supply voltage is 18.65V at 350mA
- Minimum device voltage is 9.5V
- Each device has an average load of 20mA
- Fieldbus Type A cable is 18 gauge at 22 ohms/km and is used for all cabling
- Cable loop resistance is two times the cable length (i.e. 44 ohms/loop)
- Devices are connected on one end using eight-way device couplers and the RM100 isolator is connected on the other end

Table 1: Distances per trunk load on the RM100 power supply.

Field Devices	Power Supply Load (mA)	Maximum Distance (m)
1	20	1900
2	40	1900
3	60	1900
4	80	1400
5	100	1050
6	120	820
7	140	625
8	160	500

Restrictions and limitations will vary based on actual device draw.

Installing I.S. Power Supplies

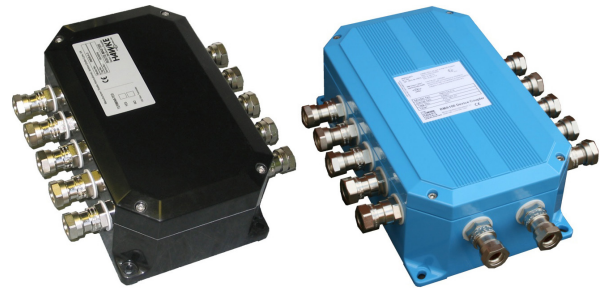
The RM100 rack can be installed in a 19" rack or surface-mounted (see below). Cables to/from the rack need to be segregated; for example, non-I.S. cables (such as AC power AKB cables or alarm output cables) should be routed away from I.S. cables and field connections (see Figure 2).



Photos show the RM100 in both rack and surface-mounted installations.

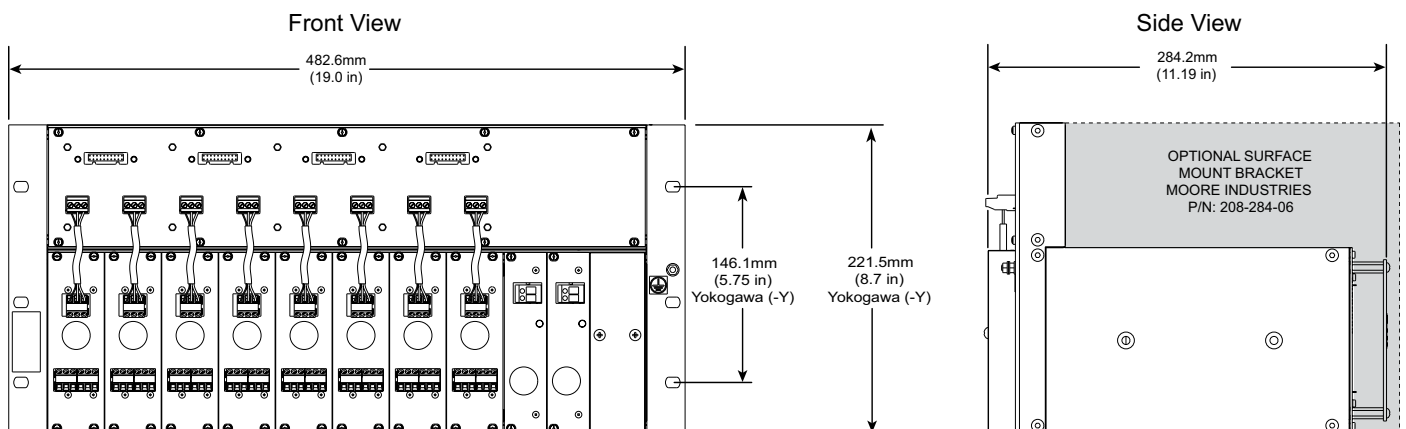
I.S. Device Couplers

MooreHawke device couplers RMA100 and/or RMA100C must be used with the RM100 power supply. The design of the system is based on a split-barrier approach where part of the barrier is in the isolator and part of the barrier is in each spur of the device coupler. If FISCO devices are to be connected, then use the RMA100C device couplers. Non-FISCO applications can use the RMA100 device couplers.



RM100A and RMA100C device couplers are available with a wide range of glands and enclosures including aluminum, Glass Reinforced Polyester (GRP) and stainless steel.

Figure 2: The ROUTE-MASTER RM100 Fieldbus Power Supply/Conditioner with Connector Panel (-Y H1 Interface) for Yokogawa host systems allows for plug-to-plug connection for eight fieldbus segments.



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Device couplers are available with four, eight, 10 or 12 spurs depending on the application need. MooreHawke can supply these for DIN-rail mounting or in various enclosures: aluminum (solid or clear lid), GRP or stainless steel. See the RM100 data sheet at <http://www.miinet.com/moorehawke> for more information on various specifications.

Application Example

The below example shows 16 fieldbus I.S. devices connected on one segment. The devices are located in different zones (0, 1 and 2) and the device couplers will be 500m from the control cabinets where the power supply will be installed. Some devices are in IIC but most are in IIB. There is a mixture of FISCO and I.S. Entity devices, with an average current draw per device of 20mA.

This solution uses the dual-trunk capacity of the ROUTE-MASTER solution. Figure 3 shows the Excel-based MooreHawke ROUTE-MASTER Segment Calculator Tool using two eight-spur device couplers.

As shown on the calculator, all devices have sufficient power (i.e. 9.57V) at 500m. Note that calculations are done for both trunks and the checks show "OK" for the device (meaning the device has sufficient voltage). The

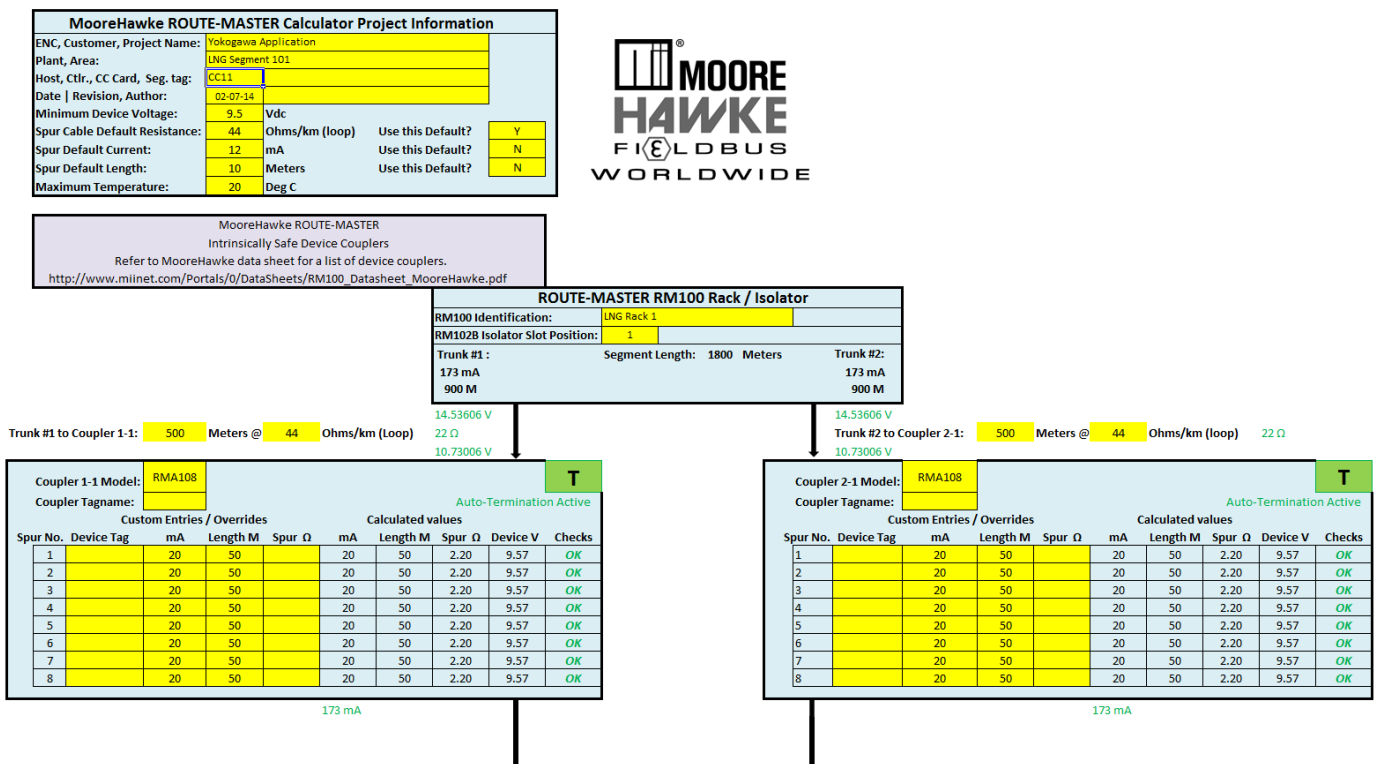
minimum device voltage set for this application is 9.5V. This minimum voltage can be changed by the designer of the segment. In this application, if the device voltage calculation drops below 9.5V, the calculator would show these fields in red and say "low voltage."

Conclusion

The ROUTE-MASTER Fieldbus System from MooreHawke offers significant advantages and expanded capabilities over competitive products. For Yokogawa customers and installations the custom ALF111 connections allow for reduced wiring and easier commissioning. Since each segment has the availability of two trunks with 350mA, the number of devices per segment can always be maximized. Users will also appreciate the ability to perform live work on the trunk and spur since they are both I.S. (Ex ia).

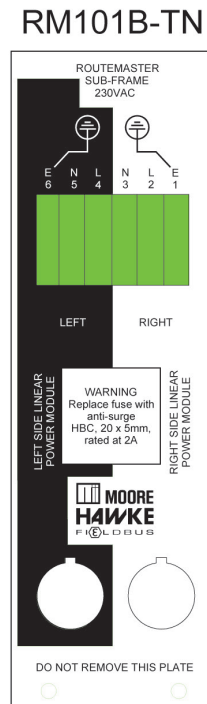
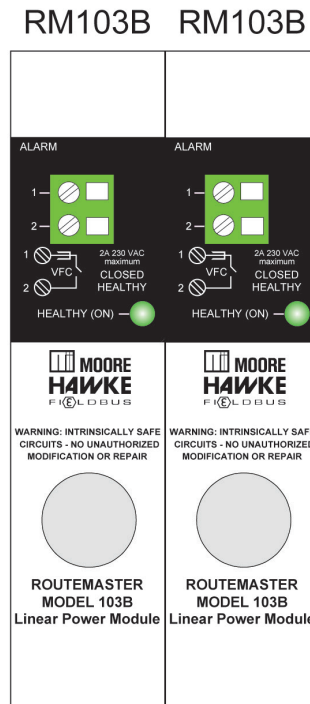
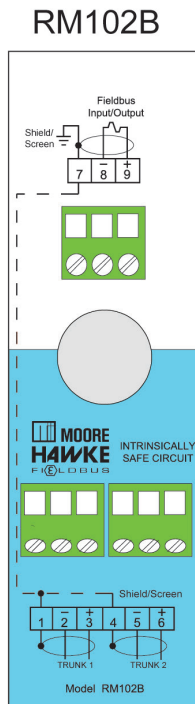
Although MooreHawke device couplers must be used, the device couplers are simple and have the advantage of direct wiring of devices from any Zone or Gas Group. Additionally, with the RMA100C couplers, FISCO or Entity devices can be directly connected. This allows for smaller enclosures since there is no need for additional barriers. The couplers also feature end-of-the-line sensing auto termination and "Fold-Back" short circuit protection (4-5mA on a short).

Figure 3: The ROUTE-MASTER Segment Calculator Tool.



Intrinsically-Safe Fieldbus Applications for Yokogawa Control Systems

Terminal Designations



DC Regulator Card Alarm RM103B	
Terminal	Function
1	Volt-Free Contact Closure
2	Volt-Free Contact Closure

TRUNK Isolator Module RM102B	
Terminal	Function
1	TRUNK 1 Screen/Shield
2	TRUNK 1 Negative -
3	TRUNK 1 Positive +
4	TRUNK 2 Screen/Shield
5	TRUNK 2 Negative -
6	TRUNK 2 Positive +
7	TRUNK 3 Screen/Shield
8	TRUNK 3 Negative -
9	TRUNK 3 Positive +

AC Power Connections RM101B-TN	
Terminal	Function
1	Circuit 1 Earth/Ground
2	Circuit 1 Live/Hot
3	Circuit 1 Neutral/Common
4	Circuit 2 Live/Hot
5	Circuit 2 Neutral/Common
6	Circuit 2 Earth/Ground



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