

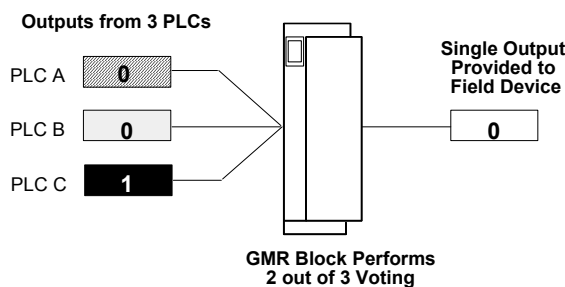
## GMR Output Voting

Unlike GMR input voting, which is done by the GMR software in the PLCs, output voting is performed *at the output block groups*. The voted state of the output is available to the GMR system to determine output discrepancies. However, the voted output state is not available to the application program.

To perform output voting, the blocks must be one of the listed types below and they must be configured (with a Hand-held Monitor) in GMR mode.

|                                    |   |
|------------------------------------|---|
| 24/48 VDC 16-Circuit Source block: | IC660BBD020                                 |
| 24/48 VDC 16-Circuit Sink block:   | IC660BBD021                                 |
| 12/24 VDC 32-Circuit Source block: | IC660BBD024                                 |
| 5/12/24 VDC 32-Circuit Sink block: | IC660BBD025                                 |
| 24/48 VDC 16-Circuit Source block  | IC660BRD020 (with internal blocking diodes) |
| 24/48 VDC 16-Circuit Sink block    | IC660BRD021 (with internal blocking diodes) |
| 12/24 VDC 32-Circuit Source block  | IC660BRD024 (with internal blocking diodes) |
| 5/12/24 VDC 32-Circuit Sink block  | IC660BRD025 (with internal blocking diodes) |

A GMR output block group performs output voting by comparing the corresponding output data for each point as received from each of the three PLCs. If all three PLCs are online, the data from at least two must match. The block group sets each output load to match the state commanded by at least two of the PLCs.



If only two of the three PLCs are communicating on the bus and they send matching output data for a point, the block group sets the output to that state.

If only two PLCs are communicating, the block group performs 2 out of 3 voting using the data from the two online PLCs and the block's configured duplex default state in place of the offline PLC data.

If only one of the three controllers is present on the bus, the block group sets output states to match the output data sent by that PLC.

If the Simplex Shutdown feature is enabled, a PLC will shut down if it determines that it is the only PLC still operating. The timeout period before it shuts down is

configurable. When the PLC shuts down and a block group is no longer receiving output data, outputs go to their default state or last state, as configured.

If all PLCs are offline, the block group forces its outputs to the block's configured default state.

### ***Duplex Default for Voted Outputs***

If a Block determines that only two PLCs are online, it uses the configured duplex default state in place of the third output in voting. This, in turn, determines whether the effect of voting will be 1 out of 2 or 2 out of 2 when only two PLCs are providing outputs. How this works is shown in the following three tables, which compare voting results for a block group receiving outputs from all three PLCs with voting results when one PLC is offline.

#### ***Results of Block Group Voting with Three PLCs Online***

The first table shows how a block group votes on outputs received from three PLCs when all three are online. The block group doesn't use the Duplex Default, so it is shown as an X (don't care).

| <b><i>PLC A<br/>Output<br/>State</i></b> | <b><i>PLC B<br/>Output<br/>State</i></b> | <b><i>PLC C<br/>Output<br/>State</i></b> | <b><i>Duplex Default<br/>Setting in<br/>Block</i></b> | <b><i>Output<br/>State</i></b> |
|--|--|--|---|--------------------------------|
| 0  | 0  | 0  | x   | 0                              |
| 0  | 0  | 1  | x   | 0                              |
| 0  | 1  | 0  | x   | 0                              |
| 0  | 1  | 1  | x   | 1                              |
| 1  | 0  | 0  | x   | 0                              |
| 1  | 0  | 1  | x   | 1                              |
| 1  | 1  | 0  | x   | 1                              |
| 1  | 1  | 1  | x   | 1                              |

#### ***Results of Block Group Voting with Two PLCs Online, Duplex Default Set to 1***

If one PLC is offline, the outputs from both online PLCs must be 0 for the voted output state to be 0. The voted output is 1 if either of the online PLCs outputs a 1.

| <b><i>PLC A<br/>Output<br/>State</i></b> | <b><i>PLC B<br/>Output<br/>State</i></b> | <b><i>PLC C<br/>Output<br/>State</i></b> | <b><i>Duplex Default<br/>Setting in<br/>Block</i></b> | <b><i>Output<br/>State</i></b> |
|--|--|--|---|--------------------------------|
| 0  | 0  |  | 1   | 0                              |
| 0  | 1  |  | 1   | 1                              |
| 1  | 0  |  | 1   | 1                              |
| 1  | 1  |  | 1   | 1                              |