

V1.0

Using a 55-58 motor driver chip and
Field-Oriented Control (FOC), the
RoboMaster C620 Brushless DC Motor Speed
Controller enables precise control over motor
torque.



Exclusively designed for the RoboMaster
C620 PMS Brushless DC Motor and
C620 Brushless DC Motor Speed Controller,
this 100W Assembly Kit includes a motor,
motor and a terminal board.

RoboMaster Speedometer Manual,
RoboMaster User Manual, Introduction
of RoboMaster System Module

The 100W Assembly Kit includes a motor,
motor and a terminal board, creating a
complete assembly system for your
RoboMaster.

ROBOMASTER 2022 UNIVERSITY SERIES

RULES FORECAST

Prepared by the RoboMaster Organizing Committee
Released on January 2022

Foreword

In order to further challenge participating teams' technical capabilities, the RMOC will modify the competition rules for RMUC Wild Card Competition, International Regional Competition, Final Tournament and RMUT Final Tournament. Some of the revisions are hereby announced.

When interpreting the rules, participating teams should always refer to the latest version of rules manual.

RMUC Exchange Station and its Mechanism

Exchange Station

The Exchange Station consists of the foundation, Mineral Receptacle and Mineral Collecting Slot.

The position of the Mineral Receptacle is variable. Taking the midpoint of the intersection between the front of the foundation and the battlefield ground as the origin O, the direction of the normal of the front of the foundation pointing to the Mineral Receptacle as the positive direction of the Y-axis, and the vertical upward as the positive direction of the Z-axis to establish a right-handed rectangular coordinate system. The position of the point E at the entrance of the Mineral Receptacle satisfies one of the following scenarios:

Scenario 1: The movement range of point E constitutes a line segment and the formula of the line segment is: $x+y+z+d=0$ ($-300 \leq x \leq 300$, $y=300$, $z=720$, $-1320 \leq d \leq -720$, the unit is mm).

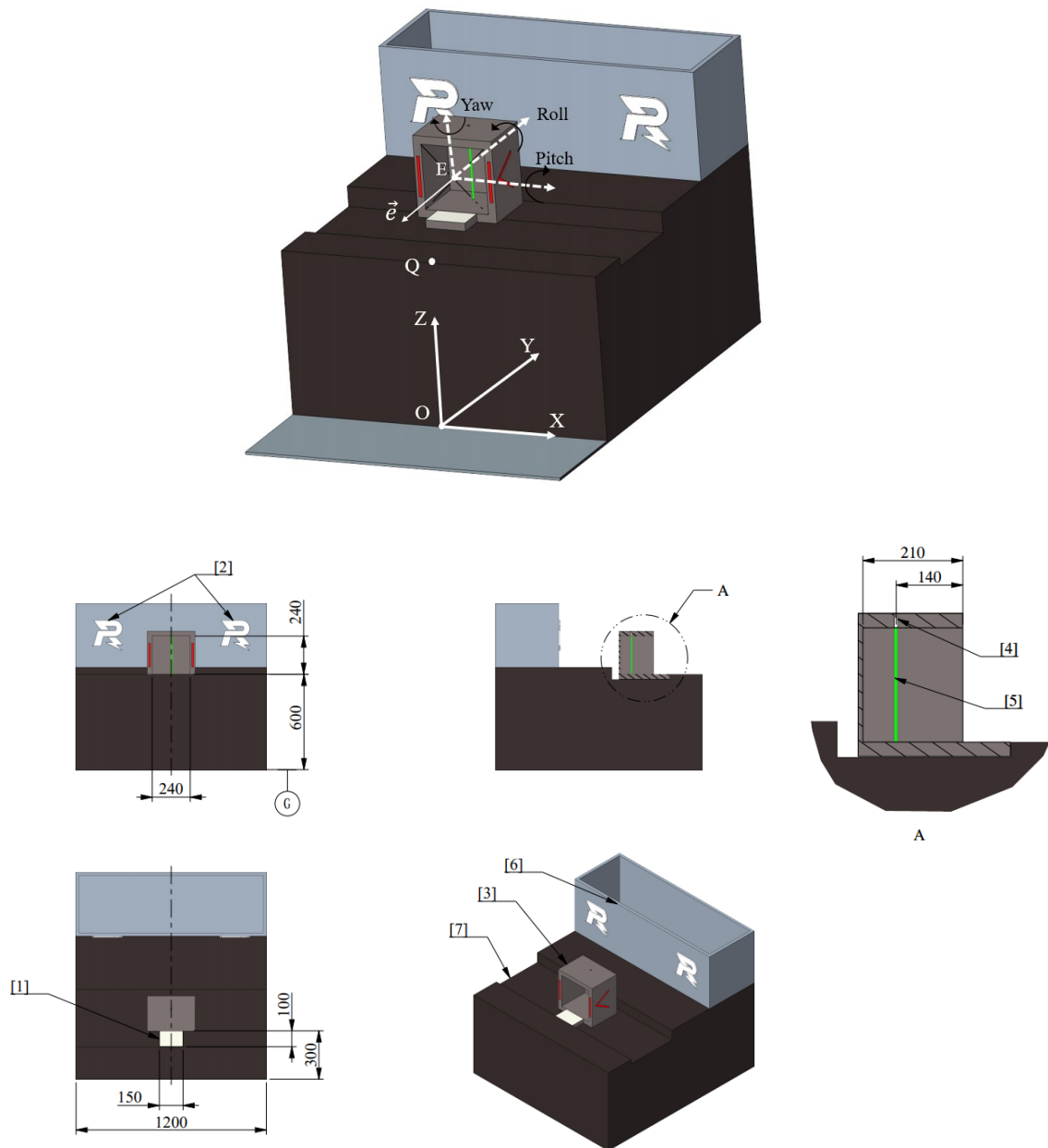
Scenario 2: The movement range of point E constitutes a part of a sphere with point Q as the center and r as the radius. The range formula is: $x^2+y^2+(z-600)^2=r^2$ ($-255 \leq x \leq 255$, $100 \leq y \leq 255$, $750 \leq z \leq 900$, $0 \leq r \leq 300$, the unit is mm).

The angle of the Mineral Receptacle is variable. Suppose the counterclockwise directions along the X, Y, and Z axes are the positive directions of Pitch, Roll, and Yaw, respectively. The normal of the entrance of the Mineral Receptacle is \vec{e} . When \vec{e} is in the same direction of negative Y axis, and the plane of the Mineral Recognition Zone is below the normal and level, the attitude angle of the Mineral Receptacle is 0. The range of the attitude angle of the Mineral Receptacle is as follows: pitch $\in [-60, 0]$, roll $\in [-45, 45]$, yaw $\in [-90, 90]$, the unit is degree.

When the Mineral Receptacle is at any position and angle, $|\langle \vec{e}, \overrightarrow{EQ} \rangle| \in [0^\circ, 90^\circ]$, and any structure of the Mineral Receptacle will not exceed the plane of the front of the foundation.



Before the quarterfinals of the RMUC Final Tournament, the coordinates and attitude angle of point E are fixed; during the quarterfinals and subsequent stages, the coordinates and attitude angle of point E will be random values within a certain range. Refer to "Exchange Station Mechanism" for details.



Mineral

- [1] Recognition Zone [2] R-figure status light indicator [3] Mineral Receptacle

[4] Photoelectric sensor

Photoelectric

- [5] sensor beam (non-visible) [6] Mineral Collecting Slot [7] Wooden foundation

Figure 1 Exchange Station



Drawings for the Exchange Station are for reference only and will be updated later.

Exchange Station Mechanism

During the competition, Engineer can place the bar code of the mineral onto the Mineral Recognition Zone of its own side before pushing it into the Mineral Receptacle. After that, the Operator should press the “N” button to complete mineral exchange.

The coordinates and attitude angle of the point E on the Mineral Receptacle will be fixed ($x=0$, $y=300$, $z=720$, $\text{pitch}=0$, $\text{roll}=0$, $\text{yaw}=0$) before the quarterfinals of the RMUC Final Tournament and vary by the accumulated exchanged gold coins during the quarterfinals and subsequent stages. Every time a mineral-exchanging operation is performed, the coordinates and attitude angle of the point E on the Mineral Receptacle will be updated once within the value range.

Table 1 Relationship between the accumulated exchanged gold coins and the coordinates and attitude angle of the point E on the Mineral Receptacle

Accumulated exchanged gold coins	Scenarios	x	y	z	pitch	roll	yaw
[0, 300)	Scenario 1	[-300, 300]	300	720	0	0	0
[300, 400)	Scenario 2	[-255, 255]	[100, 255]	[750, 900]	0	0	0
[400, 900)		[-255, 255]	[100, 255]	[750, 900]	[-60, 0]	[-45, 45]	0
[900, 2100]		[-255, 255]	[100, 255]	[750, 900]	[-60, 0]	[-45, 45]	[-90,90]

When the Operator presses the “N” button to exchange the mineral, the Exchange Station will be temporarily unavailable, with the “R” logo turned off and the Mineral Receptacle completing the exchange and starting to reset within 10 seconds. After the Mineral Receptacle is reset, the “R” logo turns on and the Exchange Station becomes available.

To exchange a mineral, the following three steps must be completed:

1. The RFID Interaction Module of the Mineral Recognition Zone must detect the RFID Interaction Module Card in the mineral (each mineral has a Card with a unique ID for recognition by the Referee System).
2. After the RFID Interaction Module detection is completed, the robot must push the mineral into the Mineral Receptacle within three seconds to trigger the photoelectric sensor.
3. When the photoelectric sensor is triggered, the Operator should press the “N” button to complete the exchange of the mineral

Mineral-exchanging logic:

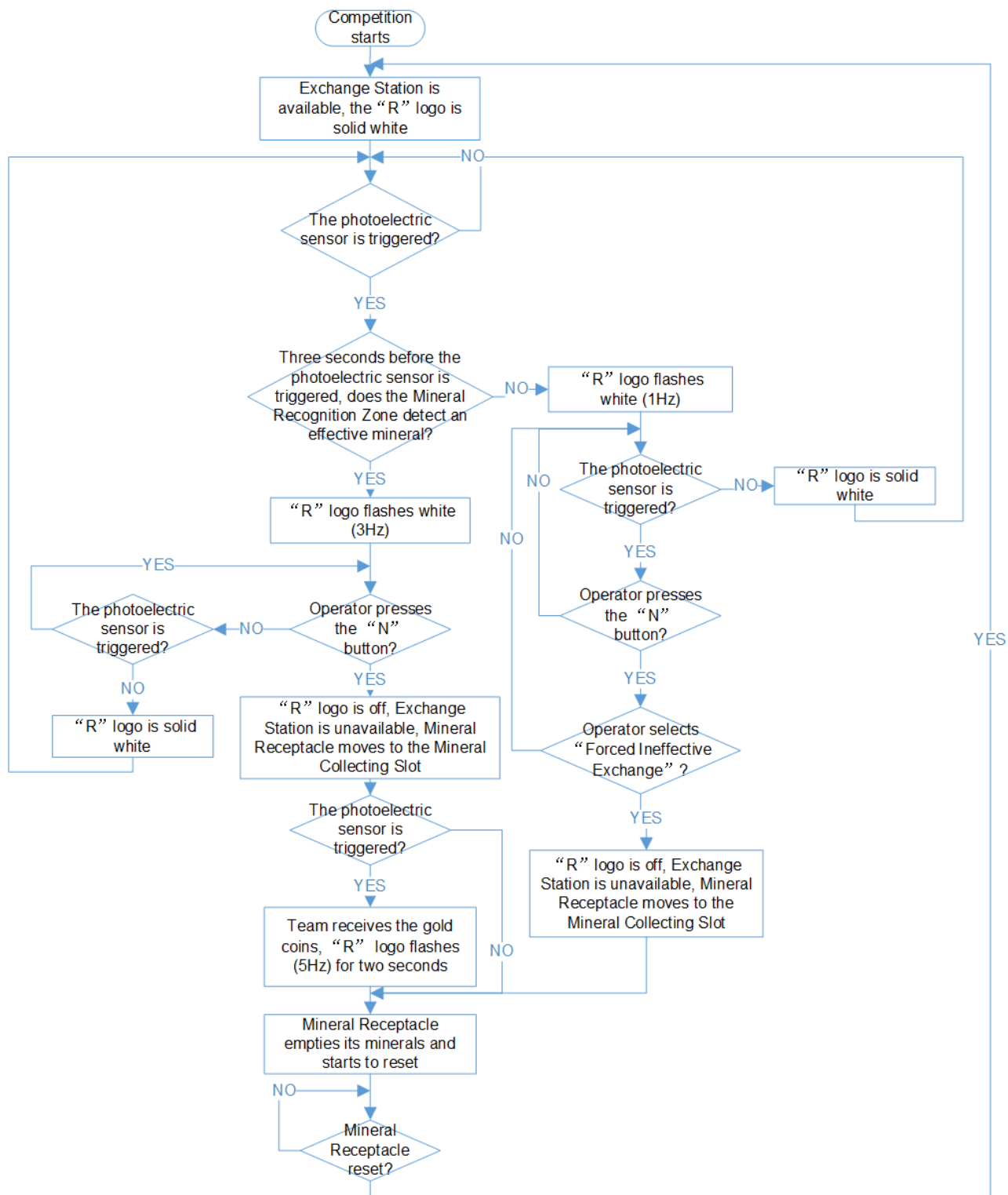


Figure 2 Mineral-exchanging logic



The other non-barcode sides of the mineral in contact with the Mineral Recognition Zone may also be detected by the RFID Interaction Module.

RMUT Engineer Mining Exchange Station and its Mechanism

Exchange Station

The Exchange Station consists of the foundation, Mineral Receptacle and Mineral Collecting Slot.

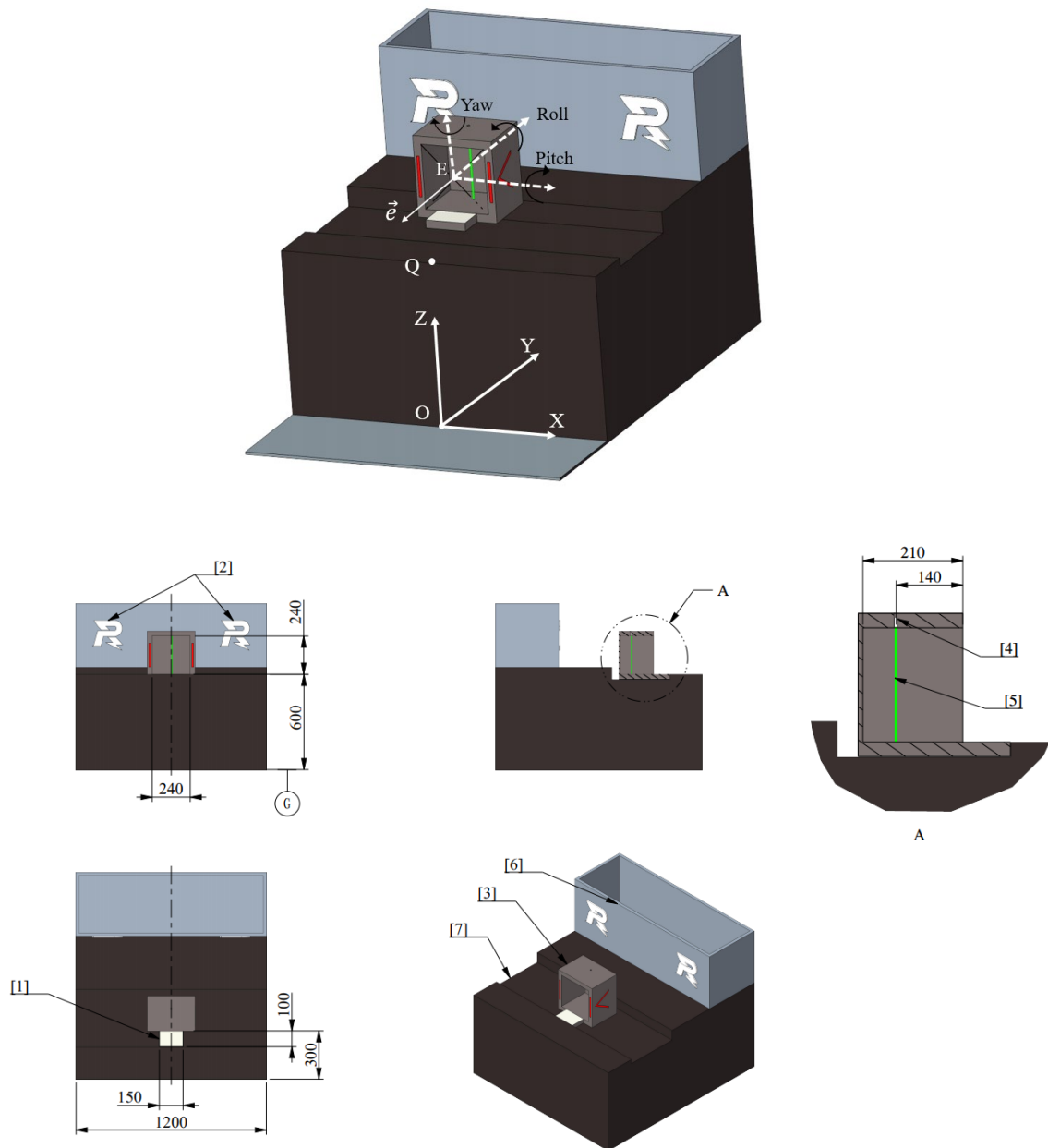
The position of the Mineral Receptacle is variable. Taking the midpoint of the intersection between the front of the foundation and the battlefield ground as the origin O, the direction of the normal of the front of the foundation pointing to the Mineral Receptacle as the positive direction of the Y-axis, and the vertical upward as the positive direction of the Z-axis to establish a right-handed rectangular coordinate system. The position of the point E at the entrance of the Mineral Receptacle satisfies one of the following scenarios:

Scenario 1: The movement range of point E constitutes a line segment and the formula of the line segment is: $x+y+z+d=0$ ($-300 \leq x \leq 300$, $y=300$, $z=720$, $-1320 \leq d \leq -720$, the unit is mm).

Scenario 2: The movement range of point E constitutes a part of a sphere with point Q as the center and r as the radius. The range formula is: $x^2+y^2+(z-600)^2=r^2$ ($-255 \leq x \leq 255$, $100 \leq y \leq 255$, $750 \leq z \leq 900$, $0 \leq r \leq 300$, the unit is mm).

The angle of the Mineral Receptacle is variable. Suppose the counterclockwise directions along the X, Y, and Z axes are the positive directions of Pitch, Roll, and Yaw, respectively. The normal of the entrance of the Mineral Receptacle is \vec{e} . When \vec{e} is in the same direction of negative Y axis, and the plane of the Mineral Recognition Zone is below the normal and level, the attitude angle of the Mineral Receptacle is 0. The range of the attitude angle of the Mineral Receptacle is as follows: pitch $\in [-60, 0]$, roll $\in [-45, 45]$, yaw $\in [-90, 90]$, the unit is degree.

When the Mineral Receptacle is at any position and angle, $|\langle \vec{e}, \overrightarrow{EQ} \rangle| \in [0^\circ, 90^\circ]$, and any structure of the Mineral Receptacle will not exceed the plane of the front of the foundation.



Mineral

- [1] Recognition Zone [2] R-figure status light indicator [3] Mineral Receptacle

[4] Photoelectric sensor

Photoelectric

- [5] sensor beam (non-visible) [6] Mineral Collecting Slot [7] Wooden foundation

Figure 3 Exchange Station



Drawings for the Exchange Station are for reference only and will be updated later.

Exchange Station Mechanism

During the competition, Engineer can place the bar code of the mineral onto the Mineral Recognition Zone of its own side before pushing it into the Mineral Receptacle. After that, the Operator need to press the “N” button to complete mineral exchange.

The coordinates and attitude angle of the point E on the Mineral Receptacle vary by the accumulated scores for mineral- exchanging. Every time a mineral-exchanging operation is performed, the coordinates and attitude angle of the point E on the Mineral Receptacle will be updated once within the value range.

Table 2 Relationship between the accumulated scores and the coordinates and attitude angle of the point E on the Mineral Receptacle

Accumulated Scores	Scenarios	x	y	z	pitch	roll	yaw
0	Scenario 1	0	300	720	0	0	0
5		[-300, 300]	300	720	0	0	0
10	Scenario 2	[-255, 255]	[100, 255]	[750, 900]	0	0	0
15		[-255, 255]	[100, 255]	[750, 900]	[-60, 0]	[-45, 45]	0
20		[-255, 255]	[100, 255]	[750, 900]	[-60, 0]	[-45, 45]	[-90, 90]

When the Operator presses the “N” button to exchange the mineral, the Exchange Station will be temporarily unavailable, with the “R” logo turned off and the Mineral Receptacle completing the exchange and starting to reset within 10 seconds. After the Mineral Receptacle is reset, the “R” logo is turned on and the Exchange Station becomes available.

To exchange a mineral, the following three steps must be completed:

1. The RFID Interaction Module of the Mineral Recognition Zone must detect the RFID Interaction Module Card in the mineral (each mineral has a Card with a unique ID for recognition by the Referee System).
2. After the RFID Interaction Module detection is completed, the robot must push the mineral into the Mineral Receptacle within three seconds to trigger the photoelectric sensor.
3. When the photoelectric sensor is triggered, the Operator should press the “N” button to complete the mineral exchange.

Mineral-exchanging logic:

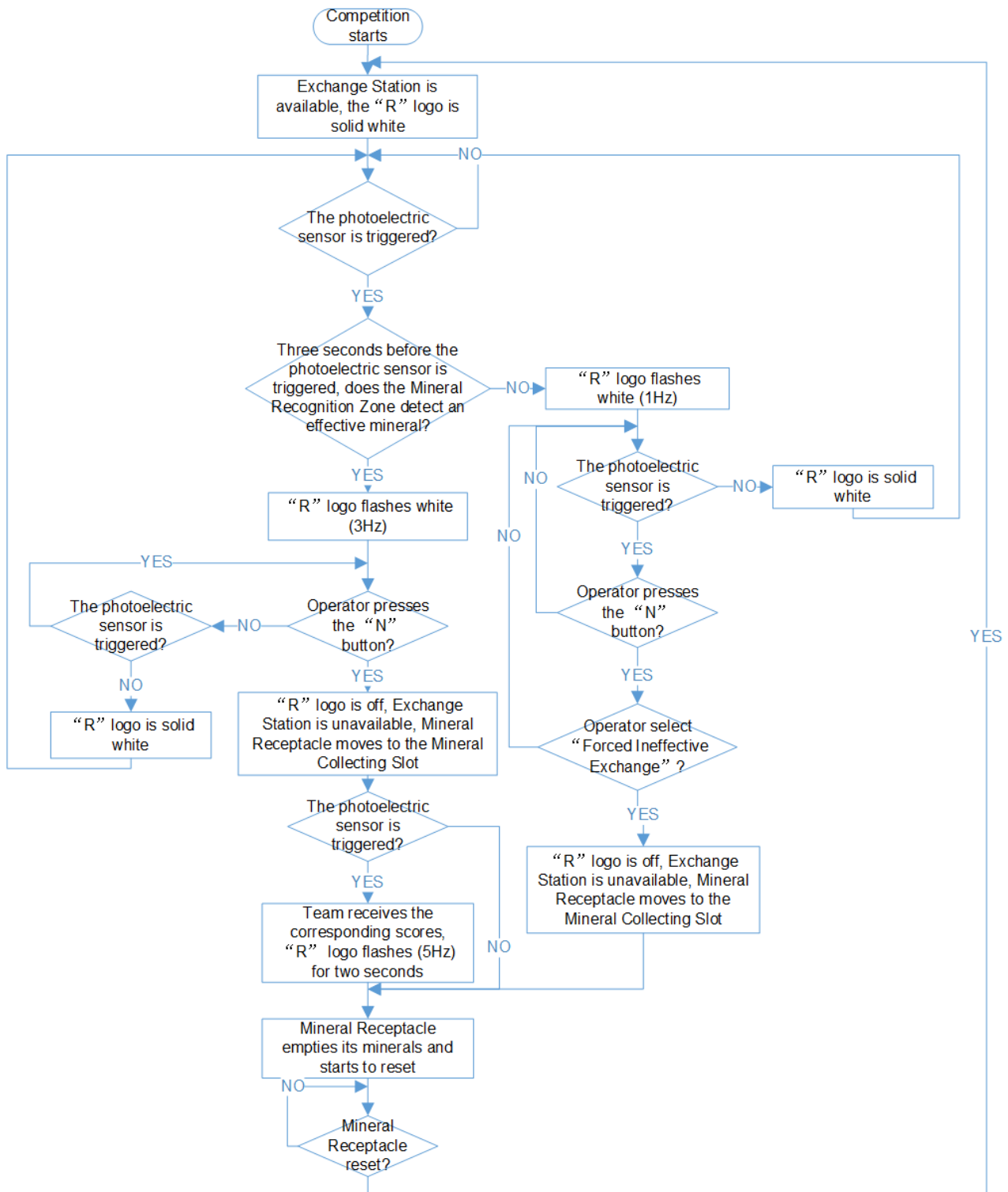
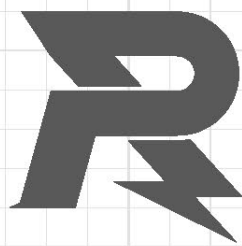


Figure 4 Mineral-exchanging logic



- The other non-barcode sides of the mineral in contact with the Mineral Recognition Zone may also be detected by the RFID Interaction Module.
- In Engineer Mining, Engineer can carry no more than one mineral each time.



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