Flipper - Detailed Documentation

The Maker Protocol's Collateral Auction House * Contract Name: * flip.sol * Type/Category: * DSS —> Collateral Auction Module * Associated MCD System Diagram * Contract Source * Etherscan * * Flip ETH-A * * Flip BAT-A * * *

1. Introduction (Summary)

Summary: Collateral Auctions are used to sell collateral from Vaults that have become undercollateralized in order to preserve the collateralization of the system. The Cat sends bitten collateral to the Flip module to be auctioned off to keepers. The collateral auction has two phases:tend anddent .

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1. Contract Details

Flipper (Glossary)

- wards [usr: address]
- ,rely
- /deny
- /auth
-
    - Auth mechanisms
- Bid
-
    - State of a specific Auction {bid
- ,lot
- ,guy
- ,tic
- ,end
- ,usr
- ,gal
- ,tab
- }
-
    - bid
-
    -
        - Bid amount (DAI)/ DAI paid
-
    - lot
-
    -
        - quantity up for auction / collateral gems for sale
-
    - guy
-
    -
        - high bidder (address)
-
    - tic
-
    -
        - Bid expiry
-
    - end
-
    -
        - when the auction will finish / max auction duration
-
    - usr
-
    -
        - address of the Vault being auctioned. Receives gems during thedent
-
    - phase
-
    - gal

-
    -
        - recipient of auction income / receives dai income (this is the Vow contract)
-
    - tab
-
    -
        - total dai wanted from the auction / total dai to be raised (in flip auction)
- *
- bids[id: uint]
-
    - storage of all bids
- vat
-
    - storage of the Vat's address
- ilk
-
    - id of the Ilk for which the Flipper is responsible
- beg
-
    - minimum bid increase (default: 5%)
- ttl
-
    - bid duration (default: 3 hours)
- tau
-
    - auction length (default: 2 days)
- kicks
-
    - Total auction count, used to track auctionid
- s
- kick
-
    - function used byCat
- to start an auction / Put collateral up for auction
- tick
-
    - restart an auction if there have been 0 bids and theend
- has passed
- tend
-
    - first phase of an auction. Increasing Daibid
- s for a setlot
- of Gems
- dent
-
    - second phase of an auction. Set Daibid
- for a decreasinglot
- of Gems
- file
-
    - function used by governance to setbeg
- ,ttl
- , andtau
- deal
-
    - claim a winning bid / settles a completed auction
- yank
-
    - used during Global Settlement to movetend
- phase auctions to theEnd
- by retrieving the collateral and repaying dai to the highest bidder.
- claw
- : reduces the amount of litter in the Cat's box
-

Parameters Set By Governance (through file)

- beg

- ttl
- tau
-

Also,Cat 'sdunk andchop also inform howFlip works as thedunk becomes theBid.lot and influences, along with thechop , theBid.tab .

Parameters Not Set By Governance

- vat
- ilk
-

Both of these are set in the constructor and cannot be changed. If the Vat address is changed and each time a new collateral is added to the system, a new Flip will need to be deployed.

Authorizations

The Flipper must beVat.wish 'ed on by theCat in order toflux duringkick .

TheEnd must berely 'ed on by the Flipper to allow foryank .

TheCat must berely 'ed on by the Flipper to allow forkick .

1. Key Mechanisms & Concepts

The Flip auction process begins with Maker Governance voters determining the collateral's minimum collateralization ratio (Spot.Ilk.mat) which is then tested against the Vault's state (collateral price, total debt owed) to determine whether the Vault is safe (SeeCat documentation for more information on thebite process). The last step of abite is tokick aFlip auction for that specific collateral. Note that the liquidation penalty gets added to thetab when theFlip auction gets kicked. This only determines when the auction switches fromtend todent . However, this amount is not added to the total debt amount (only to the part that is beingpartially liquidated) unless everything has in fact been liquidated.

Governance also determines the size of thelot (where alot is the quantity of collateral gems up for auction in aflip auction) when a Vault gets bitten. This allows for partial liquidations of large Vaults. Partial liquidations make auctions more flexible and less likely to impact the base collateral price by creating a single large auction. They also allow large Vaults to become safe again if the price recovers before the Vault is fully liquidated. Keepers will want to keep this in mind when biting unsafe Vaults as well since they will have a choice to start one or many partial liquidation auctions.

Starting in thetend -phase, bidders compete for a fixedlot amount of Gem with increasingbid amounts of Dai. Oncetab amount of Dai has been raised, the auction moves to thedent -phase. The point of thetend phase is to raise Dai to cover the system's debt.

During thedent -phase bidders compete for decreasinglot amounts of Gem for the fixedtab amount of Dai. Forfeited Gem is returned to the liquidated Urn for the owner to retrieve. The point of thedent phase is to return as much collateral to the Vault holder as the market will allow.

Once the auction's last bid has expired or the auction itself has reached theend anyone can calldeal to payout the highest bidder (Bid.guy). This moves Gem's from the Flipper's balance in the Vat to the bidder's balance.

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1. Gotchas (Potential Source of User Error)

Keepers

In the context of running a keeper (more infohere) to perform bids within an auction, a primary failure mode would occur when a keeper specifies an unprofitable price for the collateral.

- This failure mode is due to the fact that there is nothing the system can do to stop a user from paying significantly more than the fair market value for the token in an auction (this goes for all auction types,flip, flop, and flap
-).
- Keepers that are performing badly are primarily at risk during thedent
- phase since they could return too much collateral to the original Vault and end up overpaying (i.e. pay too much Dai (bid
-) for too few gems (lot
-)).
-

Bidding Requirements during an auction

Duringtend ,bid amounts will increase by abeg percentage with each newtend . The bidder must know the auction'sid , specify the right amount oflot for the auction, bid at leastbeg % more than the last bid but not more thantab and must have a sufficientVat.dai balance.

Duringdent ,lot amounts will decrease by abeg percentage with each newdent . The bidder must know the auction'sid , specify the right amount ofbid for the auction and offer to takebeg % lesslot than the last bid.

Placing Bids

When atend bid is beaten out by another bidder, the new winner's internal DAI balance is used to refund the previous winning bidder. When adent bid is beaten out by another bidder, the Flipper's gem balance is used to refund the Vault holder. Once placed, bids cannot be canceled.

Illustration of the bidding flow:

1. Catkick
2. s a new Flip Auction. The Cat emits abite
3. event with the Flipper's address and the auctionid
4. . The Flipper emits akick
5. event with theid
6. and other auction details.
7.

Starttend auction:

1. Bidder 1 makes a bid that increases thebid
2. size bybeg
3. . Bidder 1's DAI balance in the Vat is decreased bybid
4. and the Vow's DAI balance in the Vat is increased bybid
5. .
6. Bidder 2 makes a bid that increases Bidder 1'sbid
7. by at leastbeg
8. . Bidder 2's DAI balance in the Vat is decreased bybid
9. and Bidder 1's DAI balance in the Vat is increased bybid
10. (thereby refunding Bidder 1 for their now-losing bid). Bidder 2's DAI balance in the Vat is decreased bybid
11.
    - Bidder 1'sbid
12. and theVow
13. 's DAI balance is increased by the same number.tic
14. is reset tonow
15. +ttl
16. Bidder 1 makes a bid that increases Bidder 2'sbid
17. by at leastbeg
18. . Bidder 1's DAI =Vat.dai[bidder1]
19.
    - Bidder 2's previousbid
20. ; Bidder 2's DAI =Vat.dai[bidder2]
21.
    - Bidder 2's previousbid
22. . Then Bidder 1's DAI =Vat.dai[bidder1] - (bid - Bidder 2's bid)
23. and Vow's DAI =Vat.dai[bidder1] + (bid - Bidder 2's bid)
24. .tic
25. is reset tonow
26. +ttl
27. Once a newbid
28. comes in that is equal to thetab
29. thetend
30. phase is complete.
31.

Startdent auction:

Note: This phase must start before tic expires and before bid.end is passed.

1. Bidder 2 (and all the other bidders within the auction) decide it is no longer worth it to continue to increase theirbid
2. s, so they stop bidding. Once theBid.tic
3. expires, Bidder 1 callsdeal
4. and the gem tokens are sent to their Vat balance.
5.

Note: An auction can also end in thetend phase by not reachingtab before thetic orend are reached. If this happens, then the winning bidder is awarded using thedeal function and the difference between the finalbid and thetab stays as bad debt in theVow to be dealt with during aFlop auction.

The End

In the case of Global Settlement, theEnd is able to callyank on the Flipper.Yank closes atend -phase auction by returning theguy 's Dai bid and moving the Gems from the Flipper to theEnd .dent -phase auctions can continue to thedeal phase as they have already raised the necessary Dai and are in the process of returning Gems to the original Vault holder.

1. Failure Modes (Bounds on Operating Conditions & External Risk Factors)

Bounds on Operating Conditions

BecauseFlip.tend compares the bidder'sbid with the previousbid * beg , it will compare the two numbers at 10^63 precision (rad * wad). This means that anybid that is greater than 115,792,089,237,316 will cause an overflow. Governance should endeavour to not setbeg orlot (viaCat.ilks[ilk].dunk) so that it is likely that an auction keeper would end upbid 'ding that much DAI during thetend phase. This is very unlikely so long as the target price of Dai remains 1 USD, but is included here for awareness.

1.See System Stabilizer Module Documentation

1. Last Minute Auction/Low Keeper Participation Risks

Auction Grinding

Auction grinding allows an attacker to generate debt, allow their Vault to be bitten, win their own auction to get their collateral back at a discount. This type of failure is most possible when the liquidation penalty is set too low.

For the full details about this risk, reference @livnev's Paperhere .

Previous Cat - Detailed Documentation Next SCD <> MCD Migration Last updated3 years ago On this page *1. Introduction (Summary) * 2. Contract Details * Parameters Set By Governance (through file) * Parameters Not Set By Governance * Authorizations * 3. Key Mechanisms & Concepts * 4. Gotchas (Potential Source of User Error) * 5. Failure Modes (Bounds on Operating Conditions & External Risk Factors) * Bounds on Operating Conditions

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